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SUPREME COURT, U.S.

No. 105, ORIGINAL

In The

Supreme Court of the United States

STATE OF KANSAS,

Plaintiff,

v.

STATE OF COLORADO,

Defendant,

and

UNITED STATES OF AMERICA,

Defendant-Intervenor.

ARTHUR L. LITTLEWORTH, Special Master
THIRD REPORT

August 2000

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ABBREVIATIONS AND GLOSSARY

1.	Reporter's Transcript	RT Vol. ___ at ___
2.	Exhibits of Parties, and Joint Exhibits	Kan. Exh. ___ Colo. Exh. ___ U.S. Exh. ___ Jt. Exh. ___
3.	Post-Remedy Phase Briefs	
	(a) Kansas' Post-Trial Brief on Colorado's Repayment for Compact Violations 1950-1994	Kan. Post-Trial Br.
	(b) Colorado's Closing Brief on a Remedy for Past Depletions	Colo. Closing Br.
	(c) Kansas' Reply to Colorado's Closing Brief on a Remedy for Past Violations	Kan. Reply Br.
	(d) Colorado's Reply Brief	Colo. Reply Br.
4.	Acre-foot	AF, a volume of water one foot deep over one acre in area; equal to 325,900 gallons.
5.	Cubic feet per second	cfs, a rate of flow equal to 7.48 gallons per second, or 1.983 acre-feet per day.
6.	Evapotranspiration	ET, loss of water from soil by evaporation and by transpiration from plants growing thereon.
7.	Gallons per minute	gpm

KANSAS v. COLORADO THIRD REPORT

SECTION I

INTRODUCTION

This Third Report essentially completes the remedy phase of the trial for past violations of the Arkansas River Compact. Evidence was presented on injury to Kansas for the period 1950-94. Some additional depletions of State-line usable flow continued until at least 1996, and so damage figures will have to be adjusted to the time of judgment. However, it is possible that the update can be accomplished by stipulation, or at least without lengthy additional proceedings.

The trial segment on the form and amount of Colorado repayment for compact violations began on November 8, 1999, and was concluded on January 28, 2000. There were 37 trial days during this segment of the trial (RT Vols. 178-214), with 33 appearances by 19 expert witnesses. A total of 306 exhibits were offered. Evidence on money damages was heard first. Only three days at the end of the trial were devoted to Colorado's proposal to repay past depletions in water. Closing briefs were filed March 16, 2000, and reply briefs on April 24, 2000. A draft copy of the Third Report was mailed to the states on June 30, 2000 requesting comments by July 28. Some changes were made in response to those comments.

The final Kansas damage claim for money repayment, as revised during the trial, was $62,369,173. Kan. Exh. 1092, Table D7. This figure is in 1998 dollars. Colorado reserved an Eleventh Amendment objection to any damages based upon injuries to individual water users in

Kansas (RT Vol. 178 at 25-27), but subject to that reservation, Colorado's evidence on Kansas' damages amounted to $4,742,070 in "nominal dollars," i.e., the actual dollar value when the damage occurred. Colorado indicated that this total would be $9,047,075 if adjusted for inflation to 1998, but without prejudgment interest. Colo. letter dated 3/2/2000. Colorado also proposed an alternate remedy of repayment in water instead of money. The Colorado water repayment program called for the historic shortage (approximately 428,000 acre-feet from 1950 to 1996) to be repaid over 15 years at an average rate of 30,000 acre-feet per year. Kansas opposed repayment in water.

Kansas also made an alternate damage offer of proof consisting of 16 exhibits (Kan. Exhs. 985-1000, with the exception of 987). RT Vol. 190 at 66-69. These exhibits included a quantification of the benefits to Colorado arising from the use of water to which Kansas was entitled. RT Vol. 190 at 66. In my Second Report (Section XIII, a copy of which is included as Exhibit 1 in the Appendix), I rejected the legal theory that damages should be based on gains in Colorado as opposed to injuries to Kansas. Prior to the commencement of this trial segment Colorado also filed a Motion in Limine to Exclude Evidence of Colorado's Benefits from Violations of the Arkansas River Compact. That motion was granted by my July 28, 1999 Order (a copy of which is included as Exhibit 2 in the Appendix), and on the basis of that Order, the offer of proof was refused. RT Vol. 190 at 67. In its comments on the draft Third Report, Kansas states that the offer of proof was made not to support an award of damages on

the basis of Colorado gains, but rather to show the fairness of the Kansas damage claim based upon its losses, including prejudgment interest. Under the offer of proof, Kansas' damages would have amounted to $321,990,546.

Kansas analyzed its damages in four separate categories of costs or losses resulting from depletions of usable Stateline flows. These were: (1) additional costs incurred from pumping groundwater to replace depletions of surface water deliveries; (2) increased costs to pump groundwater in a larger regional area, both in the past and in the future, due to water level declines attributable to depletions of usable Stateline flows; (3) crop production losses on lands in the ditch service areas that were irrigated by surface water only, and did not have wells to replace depletions of usable Stateline flows; and (4) secondary or indirect economic losses to the Kansas economy resulting from the increased costs of pumping and crop production losses. Colorado experts did not believe that secondary impacts to the Kansas economy could be established factually, but otherwise, Colorado accepted the Kansas approach to damages (subject to its Eleventh Amendment objection), and Colorado organized its response using the same categories. RT Vol. 193 at 70-72.

Kansas did not seek separate damages for the reduction of groundwater supplies that were permanently lost because of reduced groundwater recharge and increased pumping to offset depletions of usable Stateline flows. Kan. Exh. 892, Section A at 4.

SECTION II

RECENT PROCEDURAL HISTORY

The Supreme Court issued its first opinion in this case (514 U.S. 673, 131 L.Ed.2d 759, 115 S.Ct. 1733) on May 15, 1995, confirming my First Report and the fundamental finding that postcompact well pumping in Colorado had violated Article IV-D of the Arkansas River Compact. Article IV-D provides that upstream development in Colorado shall not cause material depletions of usable Stateline flows into Kansas. On remand, additional trial proceedings were held to quantify the shortage, and to assess Colorado's current compliance with its compact obligations. The states stipulated that depletions for the period 1950-85 were 328,505 acre-feet, and I later found that additional depletions for the period 1986-94 were 91,565 acre-feet.

My Second Report, filed in September 1997, sought approval of the shortages, recognition of Colorado's compliance efforts, and a ruling on several legal issues affecting the remedy phase of the trial. Exceptions were taken only by Colorado on two of the legal issues determined. Colorado excepted to my ruling that prejudgment interest is not barred because the Kansas claim is unliquidated, and that the Eleventh Amendment of the United States Constitution does not bar an award of money damages from being based, in part, on losses incurred by Kansas water users. Kansas and the United States opposed the Colorado exceptions. Rather than hearing and deciding the issues at that time, the Court overruled the exceptions without prejudice to Colorado's right to renew those exceptions at the conclusion of the remedy phase of the

trial. 522 U.S. 1073 (1998). Section XIV (Eleventh Amendment) and Section XV (Prejudgment Interest) of my Second Report are included as Exhibits 3 and 4, respectively, in the Appendix to this Third Report.

A status conference was held on March 6, 1998, in Denver. Among other matters, Colorado was ordered to provide Kansas by September 15, 1998 (later extended to November 1, 1998) a report describing how Colorado intended to acquire and deliver sufficient makeup water to offset Stateline depletions, if a water remedy should be ordered. And Kansas was ordered to provide to Colorado by November 16, 1998, its expert reports on money damages. Colorado delivered its own expert report on money damages to Kansas in August 1999. Thereafter, additional supplemental expert reports were exchanged. Throughout this period of time, depositions of the experts and others were taken upon schedules arranged by the states.

On May 11, 1998, the trial resumed to consider compact compliance for the 1995-96 period, and the modeling and other differences which then existed between the states. At the conclusion of this trial segment, I issued an order on January 11, 1999 deciding the modeling and other issues, and ordering the states to re-run the H-I model in accordance with those decisions for the purpose of determining depletions to usable Stateline flow for the years 1995-96. This was done, and the results were presented in the form of Joint Exhibit 183. In accordance with that exhibit, I found by Order dated July 28, 1999, that depletions for the 1995-96 period were 7935 acre-feet. This Order brings the total depletions of usable Stateline flows for 1950-1996 to 428,005 acre-feet. Copies of these

two orders are included as Exhibits 5 and 6, respectively, in the Appendix.

Additional trial proceedings will still be required to assess compact compliance for the period following 1996, and to determine the sufficiency of Colorado efforts to achieve full compliance.

As part of the recent remedy proceedings, Kansas objected to certain portions of a Colorado expert report (Colo. Exh. 1096) relating to mitigation of damages. The objection was sustained in a written Order dated March 22, 2000, a copy of which is included as Exhibit 7 in the Appendix.

During the remedy proceedings, Colorado objected to the admissibility of certain expert testimony regarding secondary economic damages to the Kansas economy. This objection was based upon the "gatekeeper" requirements of *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 125 L.Ed.2d 469, 113 S.Ct. 2786 (1993) and *Kumho Tire Co., Ltd. v. Carmichael*, 526 U.S. ___, 143 L.Ed.2d 238, 119 S.Ct. 1167 (1999). The objection was overruled in a written Order dated May 1, 2000, a copy of which is included as Exhibit 8 in the Appendix.

SECTION III

WATER USE IN KANSAS AND THE NOVEMBER 1998 STIPULATION

In Kansas, this case involves primarily the reach of the Arkansas River between the Stateline and Garden City, a distance of approximately 62 miles. This portion of the Arkansas River roughly parallels U.S. Highway 50 and passes through the towns of Coolidge, Syracuse, Kendall, Lakin, Deerfield, Holcomb, and Garden City. Kan. Exh. 471; RT Vol. 27 at 50. Originally, eight canal or "ditch" companies in Kansas diverted surface flows of the Arkansas River in this reach. Today the Alamo and Fort Aubrey ditches no longer operate, although the lands formerly irrigated by these ditches continue to be irrigated by wells. RT Vol. 28 at 15; RT Vol. 178 at 75. The ditch companies now operating between the Stateline and Garden City are, in downstream order, the Frontier, Amazon, Great Eastern, South Side, Farmers, and Garden City. Kan. Exh. 872 and 873. The Frontier ditch service area is in Hamilton County. The remaining ditch companies serve portions of Kearny and Finney Counties and overlie the Ogallala groundwater aquifer. RT Vol. 178 at 60. In 1950, it was estimated that 50,839 acres were irrigated by the eight canal companies. By 1994, the irrigated acreage had declined to approximately 44,000 acres. Stipulation, Table 4B, col. b. All of this land receives surface irrigation deliveries from the Arkansas River, and in addition, some lands receive supplemental water from wells. In 1950, the percentage of lands having supplemental well water available was 43.7 percent. By 1994 this percentage had increased to 80.2 percent. Stipulation, Table 4B, col. t.

To determine money damages, it was necessary to analyze the impacts in Kansas resulting from the annual depletions to usable Stateline flows. These depletions caused reductions in groundwater recharge from the Arkansas River, as well as reductions in diversions by the ditches in Kansas. RT Vol. 178 at 61-62, 92-94. In an effort to establish these hydrologic and engineering facts before trial, I ordered counsel for the states and their appropriate experts to confer. After some six months of investigation and negotiations, the states agreed to a Stipulation that was approved in November, 1998. This Stipulation is a significant achievement by the parties and has provided a common factual basis for experts for both states from which to estimate damages.

The Stipulation includes a two-page summary for all canals in the Kansas canal service areas for each year in the period 1950-94, followed by similar two-page tables for each of the eight Kansas canals, together with an annual listing of total acres irrigated and acres also irrigated by wells. The two-page summary for all canals (Table 4B) is included as Exhibit 9 in the Appendix. The procedure used by the states in formulating the Stipulation was first to determine the depletions to groundwater recharge directly from the Arkansas River in Kansas. RT Vol. 178 at 124, 127. The remaining depletions were then allocated to the ditches in Kansas on the basis of relative shortages in crop irrigation requirements. Depletions to farm headgate deliveries were estimated by deducting estimates of canal and lateral losses for each ditch (and in the case of the Great Eastern ditch, losses due to storage in Lake McKinney.) RT Vol. 178 at 62-63. The Stipulation covers the years 1950-94, and during that period Stateline

depletions of usable flow totaled 420,071 acre-feet. Stipulation, Table 4B, col. g.

These depletions resulted in lost groundwater recharge in the amount of 220,252 acre-feet. This is the total of all net reductions in groundwater recharge due to ditch losses, reservoir seepage, farm delivery (canal) losses, and river losses. Stipulation, Table 4B, cols. ah, ai, aj, and second col. from right. When additional pumping required to offset Stateline depletions is considered, the total loss of Kansas groundwater for the 1950-94 period is 324,866 acre-feet. *Id.* at cols. ac, ad, last col. page 2.

The Stipulation also calculates the amount of pumping that was required by farmers in the canal service areas in order to make up for depletions of usable Stateline flows. This figure is 154,526 acre-feet. *Id.* at col. u; RT Vol. 178 at 69; Kan. Exh. 892, Table A1. The Stipulation also determines the amounts of the depletions to farm headgate deliveries that were not replaced by well pumping. This amount is 72,036 acre-feet for the 1950-94 period. Stipulation, col. v; RT Vol. 178 at 128. This is the shortage to the "surface water only lands."

In addition to the Stipulation allocating depletions, Kansas used, and Colorado accepted, a groundwater model to determine water level declines in the regional area, beyond the ditch service areas, resulting from depletions of usable Stateline flow. RT Vol. 178 at 76-77, 94; Kan. Exh. 874. This model was adapted by Kansas expert Steven Larson from an earlier groundwater model developed by the U.S. Geological Survey. Kan. Exh. 874 at 5-8; RT Vol. 179 at 37-39.

SECTION IV

MONEY DAMAGE ISSUES

One commentator has said, there is a "special drama" when one state sues another invoking the original jurisdiction of the Supreme Court.[1] If so, that drama is surely heightened by the money damage issues in this case. Judgments requiring the payment of money between states are rare, and historically have involved only liquidated amounts. *South Dakota v. North Carolina*, 192 U.S. 286, 48 L.Ed. 448, 24 S.Ct. 269 (1904) (amount due on bonds); *Virginia v. West Virginia*, 220 U.S. 1, 55 L.Ed. 353, 31 S.Ct. 330 (1911), 238 U.S. 202, 59 L.Ed. 1272, 35 S.Ct. 795 (1915), 246 U.S. 565, 62 L.Ed. 883, 38 S.Ct. 400 (1918) (involving payment of a proportionate share of a known debt); *Maryland v. Louisiana*, 451 U.S. 725, 68 L.Ed.2d 576, 101 S.Ct. 2114 (1981), 452 U.S. 456, 69 L.Ed.2d 156, 101 S.Ct. 3075 (1981) (refund of taxes improperly collected). There is no precedent for the calculation of money damages for violation of an interstate water compact.

This Court ruled in *Texas v. New Mexico*, 482 U.S. 124, 96 L.Ed.2d 105, 107 S.Ct. 2279 (1987) that a suitable remedy for violation of the Pecos River Compact could be in water or money, but on remand the states stipulated to a money judgment. *Texas v. New Mexico*, 494 U.S. 111, 108 L.Ed.2d 98, 110 S.Ct. 1293 (1990). The issues were not tried. The Arkansas River Compact is similar to the Pecos Compact, and in my Second Report, I concluded that

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[1] Vincent L. McKusick, Chief Justice (Retired), Maine Supreme Judicial Court, Maine Law Review, Vol. 45, Number 2, 1993.

Texas v. New Mexico is controlling and that a remedy here may be in terms of money damages or in water. Second Report at 72. In this Third Report, in Section XII, I have concluded that repayment of the shortage by making additional water deliveries, as proposed by Colorado, is not appropriate, and that Kansas should be compensated for its losses by monetary damages.

A. Legal Issues.

Damages in this case depend upon several fundamental legal issues, as well as a multitude of factual questions. The legal issues include these questions:

1. Should the measure of damages be based upon the gains to Colorado farmers resulting from the use of Kansas' entitlement, or upon the injuries suffered by Kansas from the depletions of usable Stateline flow? I recommended in my Second Report that damages should be based on Kansas' loss rather than upon any gain by Colorado. That section of the Second Report is again included here as Exhibit 1 of the Appendix. The damage segment of the case was tried on the basis of this ruling, and accordingly I granted Colorado's motion in limine to exclude evidence of Colorado's benefits (Exhibit 2 herein), and refused an offer of proof by Kansas during the trial, rejecting 16 exhibits. RT Vol. 190 at 66-69. In its comments to the draft Third Report, however, Kansas states that it was not the purpose of the evidentiary offer to provide for an award based on Colorado gains. Rather, its purpose was to show that the Kansas damage claim based upon its losses, including prejudgment interest for

all years, represented "a fair and equitable solution." *Texas v. New Mexico*, 482 U.S. at 134.

2. Does the Eleventh Amendment of the United States Constitution preclude any damage recovery to Kansas based upon losses sustained by the farmers in Kansas? Again, in my Second Report this issue was considered at length, and I recommended in Section XIV thereof that the Court should reject the Colorado argument. A copy of that section is now included as Exhibit 3 of the Appendix in this Third Report. Colorado filed an Exception to this recommendation. The Exception was overruled, but without prejudice to renewal at the conclusion of the remedy phase.

The evidence received during this recent damage phase reinforces my original ruling. A large area of southwestern Kansas, almost 800,000 acres, has suffered from the compact violations, and will continue to be damaged for decades. Over the period 1950-94 the groundwater resources of the state were permanently damaged; 324,866 acre-feet of groundwater from the Ogallala aquifer have been lost because of the depletions of surface flows. Increased costs and lost farm income in the region have also caused secondary economic impacts throughout the state. A United States Geological Report stated: "Severe decreases in flow of the Arkansas River and declines in groundwater levels pose a serious threat to the economy of southwestern Kansas." Jt. Exh. 126. I note also that while Colorado maintains that the Eleventh Amendment precludes damages based on losses to farmers, it sought in these remedy proceedings to require the Kansas farmers to drill wells in order to mitigate the

shortage of surface flows caused by Colorado. This Colorado position runs contrary to its Eleventh Amendment argument.

Subject to Colorado's right to raise the Eleventh Amendment issues as an Exception to this Third Report, the damage phase was tried using regional increases in farm costs and reduced crop yields as a measurement, in part, of Kansas' damages.

3. Can prejudgment interest be awarded, as a matter of law, on an unliquidated claim? And, if so, should prejudgment interest be included as part of Kansas' damages based upon the law and facts in this case? Colorado's initial argument that prejudgment interest may not be included on an unliquidated claim was rejected in Section XV of my Second Report, and a copy of that section is included as Exhibit 4 of the Appendix. Colorado's Exception was overruled, but with a right to renew. During the trial segment on damages, Kansas' evidence on prejudgment interest was admitted, and my analysis of the prejudgment issues, and my recommendation, appear in Section XI of this Third Report.

4. Was Kansas obligated to mitigate its damages by drilling wells? My ruling on this issue, namely, that Kansas farmers were not so obligated, is included as Exhibit 7 of the Appendix.

5. Should expert testimony by Kansas' experts on secondary economic damages have been barred by the "gatekeeper" requirements of *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 125 L.Ed.2d 469, 113 S.Ct. 2786 (1993)? My opinion overruling that Colorado objection is found in Exhibit 8 of the Appendix.

B. Factual Issues.

The factual issues, of which there were many, arose in the context of the data relied upon by the various experts in forming their damage opinions. Actually, the factual disputes could have been far more numerous had it not been for the good cooperation between the states, and the fact that Kansas has one of the largest farm record systems in the United States. RT Vol. 189 at 85-86. Colorado's counsel, in his opening statement, explained that one of the reasons for originally proposing a water remedy was Colorado's concern over whether enough data would be available, particularly in the early years, from which to estimate damages. RT Vol. 211 at 47. However, he went on to say, "I, at least, have been somewhat amazed" at how much data the economists have been able to find in regard to well pumping costs. *Id.* While he still acknowledged disagreements between the states, he viewed them as "more a matter of degree at this point rather than magnitude." *Id.*

Each state had an economist as its lead expert. For Kansas, it was Professor Norman K. Whittlesey.[2] For

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[2] Professor Whittlesey retired three years ago after serving more than 20 years as a full professor and agricultural economist at Washington State University. Last year he was honored as a Fellow of the American Agricultural Economics Association. His publications, including books, refereed journal articles, technical bulletins, published papers, conference papers, and popular periodicals, take up some 14 pages of his qualifications. Kan. Exh. 891. Many of these publications bear directly on the issues in this case, including the value of water. He testified as an expert witness for the State of New Mexico in the interstate water case involving the Pecos River and the State

Colorado, it was Professor Dennis Wichelns.[3] The basic expert report on Kansas' damages is Kan. Exh. 892, which covers the period from 1950 to 1994. This report, of which Professor Whittlesey is the lead author, was provided to Colorado pursuant to a pretrial order in November 1998, about a year before the damage phase of the trial began. Colorado's report on a water remedy was exchanged at the same time, and its money damage report was delivered to Kansas in August 1999. The basic Colorado report on money damages is Colo. Exh. 1096, of which Professor Wichelns is the sole author. The Colorado report follows the same organizational format as Kansas' report, and so year by year comparisons of data used and results can be readily made. The states exchanged rebuttal reports prior to trial.

In preparing his initial report, Kan. Exh. 892, Professor Whittlesey relied upon local, regional and some national level data. His effort was to estimate average conditions throughout the ditch service areas and surrounding region which affected agricultural costs, crop

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of Texas. He has done consulting work for the State of Idaho (Snake River), Bonneville Power Administration, Natural Resources Defense Council, U.S. Corps of Engineers, EPA, General Accounting Office (water value) and the Office of Technical Assessment of U.S. Congress (water value in irrigation).

[3] Professor Wichelns' qualifications appear in Colo. Exh. 1095. He is an Associate Professor, Department of Resource Economics, University of Rhode Island, and has held that position since 1992. The listing of his publications also requires many pages. His research and consulting work have specialized in agricultural production and irrigation, and in water economics.

yields and income. Data was collected or estimated on an annual basis beginning in 1950. The underlying hydrologic conditions (water diversions, depletions, well production, etc.) were settled by the 1998 Stipulation. The use of "average" annual data is appropriate, and is the only practical way to assess the regional impacts of the surface water depletions. Colorado used the same approach. Professor Whittlesey's first calculation of damages, as delivered to Colorado in 1998, was 77.67 million dollars. Kan. Exh. 892, Section D, Table D6 at 28.

With the Kansas accumulation of data and analyses in hand, Professor Wichelns undertook his own investigation. He concentrated first on Kansas sources to obtain as much local data as possible: from Kansas State University, Kansas Farm Facts, Kansas Statistical Abstracts, Kansas Board of Agriculture, and the Kansas Farm Management Association. As a result of this work, the preparation of Professor Wichelns' report and subsequent expert depositions, Kansas acknowledged that significant reductions in its damage claim should be made. In its opening statement, counsel for Kansas stated the damages being sought were $64 million, as opposed to the earlier calculations which placed damages at nearly $78 million. RT Vol. 178 at 14. Because of the compound interest factor, relatively small changes in the underlying data (for example, in the price of natural gas used to fuel pumps) can have significant impacts on the damage claim. It is a tribute to the professionalism of the experts on both sides that during the course of the trial, further revisions continued to be made as better data or analyses emerged. The final Kansas figures are found in Kan. Exh. 1092; the final Colorado data tables in Colo. Exhs. 1265A and B.

SECTION V

ADDITIONAL PUMPING COSTS REQUIRED TO REPLACE DEPLETIONS OF USABLE STATELINE FLOW

The first component of Kansas' damages relates to the additional costs of pumping groundwater required to replace depletions of usable flow from the Arkansas River. This category of damage was confined to the lands within the ditch service areas. The amount of additional pumping required, i.e., 154,526 acre-feet, was agreed upon as part of the 1998 Stipulation. The total was then allocated among the canal companies annually for the 1950-94 period of time. Many of the farmers had wells to supplement their surface water supplies, and as to those lands, the Kansas experts assumed that the wells would have been used to replace the surface water depletions. Professor Whittlesey suggests that it would not always be true that the well capacity of each farm was sufficient to replace depletions of surface flow. Kan. Exh. 892, Section A at 4. Nonetheless, it was conservatively assumed that all depletions would be made up by pumping, and hence, crop yield and gross income would not suffer. *Id.* at 4-5. Only increased costs were considered, with the consequent impact on net farm income.

Colorado agreed with the "basic approach used by the Kansas experts to estimate the increased pumping cost." Colo. Closing Br. at 21; RT Vol. 193 at 70-71, RT Vol. 194 at 66-67, 151-52.

A. Methodology and Factual Agreements.

Well pumping costs consist of capital costs, and variable costs such as repairs, fuel, maintenance and operation labor. The general procedure followed by the Kansas experts was first to estimate the capital investment costs for irrigation wells, pumps and motors. Kan. Exh. 892, Section A at 6. These costs have now been agreed upon by the states for the period 1950-90, although some differences still remain for the years 1991-98. RT Vol. 210 at 9; Colo. Exhs. 1232*, 1245A; Kan. Exh. 1001, Table A2. Investment costs were then depreciated in a straight line. Kansas originally used 20 years for irrigation wells, and 10 years for pumps and motors, in order to determine the annual cost of depreciation. Kan. Exh. 892, Section A at 9-10. Prior to trial, in its rebuttal report and in response to Colorado criticisms, Professor Whittlesey lengthened the depreciation period for wells to 25 years, and for pumps and power units to 15 years. Kan. Exh. 1001 at 2. He also assumed an annual use level of 2500 hours. *Id.*, Kan. Exh. 892, Section A at 18.

Professor Wichelns, the Colorado expert, also made adjustments to his report. Earlier he had taken the position that the useful life of an irrigation well in Kansas did not vary with the number of hours pumped, and he rejected the inclusion of any depreciation and interest charge in well investment costs. Colo. Exh. 1096 at 13. In his surrebuttal testimony, however, Professor Wichelns agreed that it was not unreasonable to assume that wells do wear out partly due to use, as well as to age, and he applied 50% of the depreciation and interest charges on well investment in order to determine the additional costs of pumping. RT Vol. 210 at 24-25. He also accepted

Kansas' annual interest costs which were based on interest rates for new real estate loans in agriculture. Kan. Exh. 892 at 6, 10, Table A4; Colo. Exh. 1245C.

Once annual costs of depreciation and interest were determined, Kansas divided them by the average annual hours of use over the life of the investment in order to estimate an average annual cost per hour. Kan. Exh. 892 at 6. Estimates of well pumping capacities were used to determine the number of additional hours of pumping required to replace depletions, and hence, the added fixed costs imposed by the depletions. *Id.* These fixed costs were then combined with estimated variable costs of pumping in order to estimate the total cost per hour to pump groundwater in each of the ditch service areas. *Id.* at 6, 20. Since the Stipulation established the amount of additional groundwater pumping required each year during 1950-94 to replace depletions, the cost of such pumping could be determined by dividing the volume of groundwater pumped to replace depletions by the flow rate of the wells to determine the hours of additional use. These added hours of use in each ditch service area were then multiplied by the estimated average hourly cost of pumping for each year. *Id.* at 20.

Finally, Kansas adjusted the annual cost to pump additional groundwater for estimated federal and state income tax payments, and then compounded such annual costs to include interest through 1998. *Id.* at 21. The final results of the Kansas procedure are presented in Kan. Exh. 1092, Table A18.

B. Investment Costs.

By the conclusion of the evidentiary proceedings, the states had agreed upon the original investment costs for wells, pumps and motors for the period 1950-90. RT Vol. 210 at 9.[4] However, while the differences among experts had been narrowed, there still remained these issues: (1) investment costs for the period 1991-98; (2) whether the full costs of wells should be depreciated, or only one-half thereof; and (3) whether electric motors should be depreciated over 15 or 25 years.

With respect to well investment costs for the period 1950-90, the Kansas experts originally used estimates provided by A.A. Rauhut, the former sales manager of Henkle Drilling and Supply Company in Garden City, Kansas. Kan. Exh. 892, Section A at 8. Later, records produced at deposition showed some significant differences between actual costs and Mr. Rauhut's estimates. Colo. Exh. 1108 at 10-13; RT Vol. 194 at 68-86. In response, Kansas had Spronk Water Engineers compile cost data from the actual Henkle records, and these data were included in the October, 1999 Supplement to Kansas' original expert report. Kan. Exh. 1001, Table A2. The revised well investment costs were accepted by Colorado. RT Vol. 210 at 9.

Professor Whittlesey understood initially that the Henkle data extended only through 1990. RT Vol. 179 at 161; RT Vol. 204 at 61.[5] Therefore, for the period 1991-98,

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[4] Revisions were made to the expert reports of both states.

[5] This was incorrect. Henkle did have later records.

Kansas used data from Kansas State University, Department of Agricultural Economics. *Id.* These investment costs had been collected through a survey of well drillers and well development companies in western Kansas for the purpose of establishing appraisal values. RT Vol. 179 at 161; RT Vol. 204 at 53-54, 71. Professor Wichelns, however, believed that the Kansas State University data did not "coincide well" with the Henkle data for 1986-90. RT Vol. 210 at 9. Accordingly, he adopted a different approach for 1991-98. He took the 1986-90 values from Henkle and adjusted them, using "price indices for irrigation equipment" that were taken from the Kansas Cooperative Extension Service. RT Vol. 210 at 9-10.

Colorado argues that the Kansas State University values were "substantially" higher than the Henkle costs for the years when they overlapped, and that Kansas should have continued to rely on the Henkle data. Colo. Closing Br. at 25. Professor Whittlesey recognized that the KSU data were somewhat higher, and so he averaged the 1988-98 costs and used that result for the next three years (1996, 1997 and 1998). Kan. Exh. 1001 at 2, RT Vol. 204 at 64-65. He believed that this was a "conservative" approach. RT Vol. 204 at 54-55. In any event, the overlap with Henkle 1986-90 data was brief, and any comparison was much dependent upon the well depths selected. Colorado maintains that Professor Whittlesey could have obtained additional Henkle data for the period after 1990, but did not do so. Of course, Colorado did not do so either. Instead, Professor Wichelns relied upon a price index for irrigation equipment to adjust the 1986-90 Henkle costs. RT Vol. 210 at 9-10. There was no evidence to support the view that an equipment index was an

appropriate method of estimating construction costs of a well.

With respect to depreciation, Colorado expert James Slattery testified that the average age of wells within the ditch service area was approximately 34 years (in contrast to 20 years, revised to 25, used by Kansas). Colo. Exh. 1076 at 2, RT Vol. 191 at 27. Moreover, it was Professor Wichelns' initial view that the useful life of an irrigation well did not vary with the number of hours pumped. Colo. Exh. 1096 at 13. Hence, he concluded that it was not appropriate to include depreciation or an interest charge on well investment costs. *Id*. The average age of 34 years was computed by Mr. Slattery from a well database developed by the Kansas Division of Water Resources. Colo. Exh. 1076 at 2. It became clear, however, that this database did not record all re-drills of wells. It showed only the last year "if replaced more than once." Hence, in the Colorado averaging process, one well was assumed to be 85 years old, and more than 30 wells exceeded 60 years. Kan. Exh. 1043. Dale Book, a principal Kansas expert during the liability phase of the trial, properly concluded that the database did not include complete information from which the useful life of wells could be determined, and he did not use that evidence. RT Vol. 209 at 27-28. Based upon references in the literature, testimony in the 1990 phase of the trial, and more recent consultations with local well experts, Book testified to a useful life of 25 years, and Professor Whittlesey extended his depreciation period on wells from 20 to 25 years. RT Vol. 209 at 28-29; RT Vol. 202 at 103-104. This is also the well life that Professor Wichelns used in his original

report for Colorado. RT Vol. 202 at 77-78; RT Vol. 210 at 12.

Professor Wichelns, in his surrebuttal testimony, modified his position that wells wear out only with age, and not by use. RT Vol. 210 at 24-25. As a "compromise" with Kansas, he allocated 50% of the depreciation and investment charge to irrigation wells. *Id*. at 24. There was ample evidence, however, to support the consistent Kansas view that wells do depreciate with use. RT Vol. 202 at 78, 101-03; RT Vol. 209 at 28-29; Kan. Exh. 1002 at 1-3. Pumping affects the water table, and can cause problems of cascading water and air, sanding, plugging of filters, and casing deterioration. All of these impact the useful life of a well, and when it may have to be re-drilled. RT Vol. 209 at 28-29.

Professor Whittlesey depreciated electric motors over 15 years, although he acknowledged that there was some general literature support for using 25 years. In this case, however, after consulting with local people in the well business concerning the type of electric motors actually being used, and considering the fact that electric wells were being replaced rapidly as natural gas became available, he concluded that 15 years was an appropriate life to use in this case. RT Vol. 204 at 76-77. This was a reasonable approach.

C. Variable Costs of Pumping.

In addition to capital or fixed costs, the variable costs of increased groundwater pumping must be considered. These are costs for repairs, fuel (electricity or natural

gas), power unit maintenance, well operation labor, gear oil, engine oil, and drip oil. Gear oil is used to lubricate the gear box in gas engine systems. Engine oil is used in natural gas engines. Drip oil is used for lubricating the column that drives the turbine. These minor costs of lubrication were adjusted downward by Kansas to accept the values used by Colorado. Kan. Exh. 1001, Table A9; Colo. Exh. 1096, Table CO-A9. Thus, the states are now in agreement on these lubrication costs. However, the more significant costs of repairs, fuel and labor remain in dispute.

1. *Repair Costs.*

Kansas experts originally estimated repair costs from records of the Garden City Company which included total well expenses for the years 1971 through 1996. Kan. Exh. 892, Section A at 10-12; Table A5. These were records on 67 to 88 wells, depending upon the particular year examined. *Id.* Professor Whittlesey's procedure was first to remove the annual variation in these repair costs, and to extend the data over the entire 1950-96 period since there were no records for the period 1950-70. Kan. Exh. 892, Section A at 11; RT Vol. 204 at 81. This was accomplished using a well cost index constructed from the average total cost of well investment, normalized in 1998. Kan. Exh. 892, Section A at 11, Table A5, col. e. The index transformed annual repair costs per hour to a 1998 value. These costs were then averaged for the 1971-96 period, and the average value ($1.38 per hour) was extended back in time to 1950 using the well cost index. *Id.* at 11, Table A5. The result of this procedure was to produce

annual repair costs per hour for groundwater pumping in the ditch service area.

However, as Professor Wichelns pointed out in his report for Colorado, these "total well expense" data included expenditures in addition to repairs. Colo. Exh. 1096 at 20. Although the Kansas experts had not understood this when undertaking their original investigation, they acknowledged during the trial that these data did include costs for lubrication, power unit maintenance, and well operation labor. RT Vol. 185 at 16-17. These items had been separately estimated by Kansas as additional variable costs, and so they had to be removed from the repair computations in order to eliminate double counting. RT Vol. 204 at 117. The modified repair costs are now shown in Kan. Exh. 1074, col. (b). Average per-hour repair costs in 1950 show a reduction from 24 to 17 cents, and in 1998 from $1.34 to 79 cents. Lubrication and labor costs are shown separately in Kan. Exh. 1092, Table A9.

Colorado, on the other hand, relied upon three studies of irrigation pumping costs for the early years, and after 1982 upon detailed records maintained by the Garden City Company for each of its wells and engines. The results of its work appear in Colo. Exh. 1096, Table CO-A5. From the three studies, Professor Wichelns had repair values for 1950, 1961 and 1966, and then in 1982 from the Garden City Company records. Colo. Exhs. 1114, 1115, 1201. Intervening annual values were calculated by interpolation among these data points. RT Vol. 195 at 55-56. From 1982 forward, the Garden City Company data were used. *Id.* at 56. A side-by-side comparison of Kansas and Colorado repair costs appears in Kan. Exh. 1074, col. (b).

Neither state is exempt from valid criticism about the accuracy of its results – which may not be surprising considering the historic time period involved. The final revisions to the Kansas data were not made until after both Kansas and Colorado had completed their cases in chief. Kan. Exh. 1074 cf. to Kan. Exh. 1001; RT Vol. 204 at 102-03. Even then, Kansas did not take advantage of specific repair records that had become known during depositions. Colo. Exh. 1113 at 21-24, Deposition Exh. 9. Rather, Professor Whittlesey used an oblique approach, calculating repairs as the residual of certain expenses. This approach involved using the IEES model to calculate lubrication and certain labor expenses, and then deducting those costs from the Garden City Company's "total well expenses" to get repair costs. RT Vol. 204 at 117. These costs were then extended over the 1950-70 period using the well cost index. One of the problems with this use of the well cost index is the assumption that repair costs are roughly proportional over time to total well investment costs. However, by 1971, all but one of the Garden City Company wells were powered by natural gas engines, whereas in 1950 almost half had electric motors. Kan. Exh. 892, Table A7; RT Vol. 204 at 91-92, 96-97. And there was substantial evidence indicating that repair costs for electric motors were much less than repair expenses for natural gas engines. Kan. Exh. 1065 at 15; RT Vol. 204 at 84, 87; Colo. Exh. 1115 at 51-52.

Looking to the Colorado repair costs, Professor Whittlesey in his rebuttal testimony pointed to certain deficiencies in the three studies on which Colorado relied for values during the 1950s and 1960s. RT Vol. 202 at 105-117. The 1950 data point does appear weak. However, there

are strong data in the Sirohi and Trayer Studies which Professor Whittlesey did not appear to consider. Colo. Exhs. 1114, 1201. On rebuttal, Professor Whittlesey essentially recognized these anchor points. RT Vol. 203 at 13-14; Kan. Exh. 1074. The Trayer thesis was based on a survey of 75 Kansas Farm Management Association members in southwest Kansas in 1966. Colo. Exh. 1201 at 26-27. The survey included 158 irrigation wells, most of which were powered by natural gas. *Id.* at 38. It is true that some responses were given in round numbers, indicating less than complete accuracy. But despite Kansas' doubts, the repair cost estimate from this study (20 cents per hour) was not much less than the final revised estimate of the Kansas experts (24 cents per hour).

For the year 1982 and forward, Colorado used individual well record sheets produced by the Garden City Company on deposition. Colo. Exh. 1113, Deposition Exh. 9 and 26. The general manager of the company testified that these records showed "all costs for repairs." *Id.* 21-24. These sheets described each item of repair work done, the date, and the cost. It is true, as Professor Whittlesey pointed out, that some work seemed to include capital items rather than mere repairs. But that only increased the "repair" costs, to the advantage of Kansas. It is also true that some sheets show repair work done without a cost, or without accounting for shop labor. The vast majority of the sheets, however, are extremely detailed and complete.

The Colorado approach is more straightforward, and while the early data are sketchy, I find that the weight of the evidence supports the use of Colorado's repair costs.

2. *Electricity Costs.*

Rates paid for electricity to pump groundwater originally represented a significant cost difference between the states. Kan. Exh. 892, Table A8; Colo. Exh. 1096, Table CO-A8. The Kansas experts at first used electricity prices obtained from Rodger Funk, a farmer in the ditch service area who is a member of the Kansas Farm Management Association, and who maintained detailed records of his farm expenses. RT Vol. 182 at 49. Kansas had attempted to obtain records from the local power company, Wheatland Electric Cooperative, Inc., but had been told that such records did not exist. RT Vol. 182 at 51.

As the experts found out later, the Funk records were for tailwater pumping, not for irrigation wells. Tailwater pumps have shallow lifts and use a relatively small amount of electricity. Since Wheatland employed a declining block rate system of pricing, i.e., the greater the use, the lower the rate, the Funk rates for tailwater pumping were high. They substantially over-estimated the electricity costs for irrigation pumping generally. RT Vol. 194 at 153-54. It was also learned that the Wheatland Electric Cooperative had actually filed reports with the Kansas Corporation Commission showing all of its rates, including irrigation rates, from 1949. RT Vol. 182 at 52. These data from the Kansas Corporation Commission were supplied by Kansas to Colorado in April, 1999, and were used by Professor Wichelns in his report. Colo. Exhs. 1133, 1134; RT Vol. 194 at 154-55. Kansas subsequently revised its electricity rates in the October, 1999 Supplement to its primary report. Kan. Exh. 1001, Table A8.

There remain minor differences for electric rates in the expert reports for the two states, but the overall impact of the differences is not consequential. After the mid-1960s, virtually all wells were powered by natural gas engines, and electricity costs ceased to be a factor in assessing additional pumping costs. Kan. Exh. 1092, Table A7. Professor Wichelns in his report held electricity prices constant at one cent per kWh from 1950 to 1974. Colo. Exh. 1245E. The rates finally used by Kansas were sometimes slightly under, and sometimes slightly over, one cent per kWh. Kan. Exh. 1001, Table A8. The variation depends upon the differences between summer and winter irrigation rates, and on that basis the Kansas schedule should be used.

3. *Natural Gas Costs.*

Based upon the records of the Garden City Company, the numbers of natural gas and electric wells used in the ditch service areas were about equal in the early years. However, by the mid-1960s, virtually all irrigation wells had been converted to the use of natural gas engines. Kan. Exh. 892, Table A7. At first, the experts disagreed sharply over natural gas costs. Kan. Exh. 892, Table A8; Colo. Exh. 1096, Table CO-A8. However, the Kansas experts subsequently revised their gas costs downward, close to the rates used by Professor Wichelns for Colorado. Some small differences still remain. Kan. Exh. 1092, Table A8.

Professor Whittlesey initially had relied upon the natural gas prices paid by commercial customers. Kan. Exh. 892, Section A at 15. He stated in his report for

Kansas that while farmers had faced a range of natural gas prices over time, he thought that the rates used adequately represented "the average gas prices faced by study area farmers from 1950 to 1996." *Id*. However, Professor Wichelns, the Colorado expert, pointed out that these natural gas prices were substantially higher than those reported by farmers in their 1990 testimony during the liability phase of the trial. Colo. Exh. 1096 at 16-17; RT Vol. 33 at 28-30. One reason for lower prices in the trial testimony is the fact that southwest Kansas overlies a large gas field. Many farmers have natural gas wells in or near their farm fields, and can purchase gas at "wellhead" prices which are much lower than those charged to commercial customers for "pipeline" gas. Colo. Exh. 1096 at 16-17. Professor Wichelns, therefore, constructed an alternate series of natural gas prices based upon the earlier trial testimony of farmers, the records of the Garden City Company, and the records of Rodger Funk, taking into account the availability of wellhead gas. RT Vol. 195 at 19-46, Colo. Exhs. 1121, 1123A and B, 1124-26, 1128-30.

In response to Colorado's criticisms, Kansas undertook a further investigation of gas prices. The work was done by Dale Book, who has been involved in considerable data collection and analyses since commencement of the trial in 1990. He received and tabulated information on both wellhead and pipeline prices, and developed a weighted annual price series. RT Vol. 209 at 35. Pipeline rates came from filings with the Kansas Corporation Commission by the Kansas-Nebraska Company, the largest supplier in the area. *Id*. at 36. Prices paid for wellhead

gas vary from farm to farm depending upon lease conditions, and are not reported. A further complicating factor is the increase that has occurred in more recent years in the price of wellhead gas as production from some gas wells declined. Book, however, had some specific data points from the Garden City Company records, and from prior trial testimony by farmers. RT Vol. 209 at 36-40. He prepared a weighted prices series which represents the use of 65 percent wellhead gas and 35 percent pipeline gas. Kan. Exh. 1092, Table A8.

The apportionment between the use of wellhead and pipeline gas became the principal difference between the costs used by the respective experts. Book was aware that farmers in the 1950s and 1960s used both wellhead and pipeline gas, but there were no records evidencing the split between the two sources. RT Vol. 209 at 56-57. However, between 1981 and 1988 the records of the Garden City Company showed that pipeline gas comprised from 35 percent to 45 percent of the total gas used. RT Vol. 209 at 36, 51. Thereafter, according to David Brenn, manager of the Garden City Company, the ratio remained relatively constant at 60-40. *Id*. at 51. Brenn further stated that this ratio would be representative for other users in Finney County. *Id*. at 52. Mr. Book finally adopted a 65-35 percent ratio for the whole ditch service area, and extended that back in time over the earlier years. RT Vol. 209 at 56-57. Colorado suggests that the ratio of pipeline gas was less in the early years, but there is no good evidence to show that the ratio changed over time. Colorado cites the testimony of six farmers who testified earlier in the liability phase of the trial. They appear to have used only wellhead gas, but that is not to say that all

farmers had wellhead supplies available. Colo. Exh. 1121. I find that the weight of the evidence supports the conclusion reached by the Kansas expert.

Professor Wichelns, on the other hand, included no weighting for the use of pipeline gas during the first 20 years. RT Vol. 209 at 39-40. For all of the years after 1973, Professor Wichelns relied wholly on the records of Mr. Funk. RT Vol. 210 at 15-16. Apparently these records included the purchase of some pipeline gas, although it is not clear how much, and Mr. Book believed that it was less than 35 percent. RT Vol. 209 at 42. There are several problems in placing sole reliance upon the Funk records. First, the sample was very small. He had only 7 wells out of a total of 618 wells in the ditch service areas. RT Vol. 209 at 42; Colo. Exh. 1076, Table 2. Secondly, some of the prices in the Funk record were apparently off by a factor of ten. The decimal points were misplaced, seriously underestimating the prices. RT Vol. 209 at 60-64. Mr. Book examined the Funk records and found the discrepancies, and his previous work in this case in analyzing and tabulating complex sources of data leads me to rely upon his testimony. Finally, beginning in the early 1980s, wellhead gas was affected by substantially higher prices on "stripper wells," and this is not reflected in the Funk records. RT Vol. 209 at 37-38.

The weighted natural gas price developed by Mr. Book for 1990 corresponds closely to prices actually paid by farmers at that time, according to their earlier trial testimony. RT Vol. 209 at 42. Mr. Book's weighted price for that year was $2.35 per mcf, while in contrast the Funk records showed only $1.24. RT Vol. 209 at 43.

I find that the natural gas prices to be used should be those tabulated in Kan. Exh. 1092, Table A8. The 1998 price of $2.19 mcf is significant because that value is used to estimate future regional pumping costs. In that category of Kansas' damages, the price of natural gas is held stable at the 1998 level for the next 50 years. RT Vol. 209 at 70-72, Kan. Exh. 1014, Table 4.

4. *Pump Lifts Within The Ditch Service Areas.*

The "pump lift," as the term is used in this case, represents the number of feet required to raise groundwater to the surface of the ground. Pump lifts were calculated by Kansas as the average static groundwater level for each canal service area, at 5-year intervals, added to a constant drawdown caused by pumping. Such pump lifts were used in the calculation of the cost of additional pumping to replace reduced farm deliveries due to depletions. Kan. Exh. 1014 at 3. Colorado did not object to the static water levels used in the analysis, but recommended some modifications in the pumping drawdowns. Changes were made in the data used by both states, and Mr. Book and Mr. Slattery, Colorado's expert, came to agree upon the appropriate pump lifts to be used in the cost analysis. RT Vol. 191 at 43-44; RT Vol. 209 at 29-30; RT Vol. 210 at 14. The revised and agreed-upon data now appears in Kan. Exh. 1014, Table 2; Kan. Exh. 1092, Table A6; Colo. Exh. 1245D, Revised Table CO-A6.

5. *Agricultural Wage Rates.*

As part of the labor costs incurred by additional pumping, Kansas first relied upon average wage rate data published by the United States Department of Agriculture for the Great Plains States. Kan. Exh. 892, Section A at 19; RT Vol. 184 at 140-41. These data covered the period from 1950 to 1974. Beginning in 1971, Kansas had data available from the Kansas State University Extension Service. These data covered the period from 1971 to 1996, excluding the years 1972-73 and 1995. Kan. Exh. 892, Section A at 19. A comparison of the national data with the Kansas State University data for the two years when they overlapped, namely, 1971 and 1974, showed that the national data were approximately 30 percent lower. Accordingly, Kansas adjusted each of the national values for 1950-70, multiplying each by the scale factor 1.3. For the remaining years, 1973-94, the Kansas data appear to be quite gross, reported in even numbered dollars sustained for several years, with an occasional significant jump, e.g., $4.00 to $6.00 per hour wage. Wage rates used by Kansas in its analysis are found in Kan. Exh. 892, Table A9, and Kan. Exh. 1092, Table A9.

Colorado, on the other hand, relied upon data from annual reports known as the "Kansas Farm Facts," and upon Kansas Statistical Abstracts. RT Vol. 193 at 129-32. The Kansas Farm Facts were reports published annually from the 1930s by the Kansas State Board (since 1995 the Department) of Agriculture for the Kansas State Legislature. RT Vol. 193 at 101; Colo. Exhs. 1158-1165. Data in the Kansas Farm Facts reports were collected on a county-by-county basis, including Hamilton, Kearny and Finney

Counties, and included comprehensive statistics on acreage irrigated, crop yields, revenue, etc. RT Vol. 193 at 103. In some years, these reports also included a section on "Farm Labor and Wage Rates." RT Vol. 193 at 117. Professor Wichelns used these data for most years from 1950 to 1974. For the period 1975-94 he relied on the Statistical Abstracts published by another Kansas state agency. Colo. Exh. 1152; RT Vol. 193 at 131. As he noted, it was not necessary to use and adjust national statistics when specific local information was available. RT Vol. 193 at 118. I agree with Professor Wichelns, and find that the Colorado data on labor costs should be used in the damage analysis. When used in the pumping cost analysis, the lower Colorado labor costs decrease Kansas' damages. However, I see no reason why the same labor costs should not apply to Section VII on crop production losses. In that situation they will act to increase Kansas' damages.

D. Federal Income Taxes.

After estimating the annual costs to pump additional groundwater to replace depletions of usable surface diversions, the Kansas experts adjusted the costs to account for payment of federal income taxes. Kan. Exh. 892, Section A at 21. Professor Whittlesey reasoned that if well owners in the ditch service areas had not been required to incur additional costs to pump groundwater, they would have realized additional net farm income. However, this additional income would have been subject to both federal and state income taxes. *Id.* Kansas, therefore, reduced its damage claim by the amount of federal

income taxes that would have been paid, since they were not losses to the State of Kansas. State income taxes, however, were computed separately, since they were direct losses to Kansas on the additional net farm income that would have been realized, except for the surface water depletions.

Professor Wichelns, Colorado's expert, agreed that it was appropriate to adjust the estimates of annual pumping costs to account for federal and state income taxes. Colo. Exh. 1096 at 23. Moreover, the experts for both states agreed on the use of average "effective" marginal tax rates.[6] Kan. Exh. 892, Section A at 22-23. The specific tax rates to be used are discussed in Section IX of this Report.

E. Conclusions.

The additional costs of pumping groundwater to replace depletions of Arkansas River water are appropriate damages to be included in the Kansas claim. The methodology followed by the Kansas experts in estimating these costs is proper. These costs should be recalculated using the Kansas capital and variable costs, as revised (Kan. Exh. 1092), except for repair and agricultural wage rates. Colorado data should be used for these costs.

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[6] Professor Whittlesey reduced the marginal tax rates by 15% to account for the tax management opportunities available to farmers. Initially, Professor Wichelns did not agree, but later accepted this adjustment.

SECTION VI

REGIONAL GROUNDWATER DAMAGES

The second category of injury to Kansas results from a regional decline in groundwater levels. The states agreed in their November, 1998 Stipulation that the total loss of groundwater in the region for the period 1950-94 amounted to 324,866 acre-feet. Stipulation, Table 4B. This amount represents the loss of groundwater recharge from the Arkansas River, as well as from the increased pumping required to offset depletions of usable flow. The region affected comprises about 790,000 acres, in portions of Kearny and Finney Counties, which were studied by the U.S. Geological Survey in USGS Water Supply Paper 2253. Jt. Exh. 140; Kan. Exhs. 872, 873 and 874.

Kansas analyzed its damages resulting from the lower static groundwater levels throughout the region in terms of increased costs of pumping. Historic water level declines for the period 1950-94 are shown in Kan. Exh. 892, Table B1. Since these lower water levels will continue in the future, absent a water remedy, the Kansas experts also estimated future pumping costs for the next 50 years, from 1998 to 2048. Future additional pump lifts due to compact violations are shown in Kan. Exh. 892, Table B6.

In estimating these additional regional pumping costs, Kansas experts followed much the same procedures they used in the ditch service areas, discussed in Section V. However, they included only variable costs, and from these they also excluded repair costs. Kan. Exh. 892, Section B at 7. Capital investment costs and repair costs were not included in the damage analysis since they were considered to be functions of the amount of time a well is

used, rather than the depth from which water is pumped. RT Vol. 184 at 37-39. Professor Wichelns, for Colorado, agreed with the basic Kansas approach, although he disputed certain estimates of variable costs as discussed in Section V, and these differences also apply to regional pumping. Colo. Exh. 1096 at 38. Colorado, however, did not contest the revised pumping estimates used by Kansas, nor the changes in groundwater levels. RT Vol. 209 at 30-31; RT Vol. 191 at 43-44. In projecting future pumping, Kansas assumed that it would be equal to the average pumping for the period 1991-96, adjusted to climate conditions for the period 1950-96. RT Vol. 178 at 108-111. The Kansas analysis was based upon the assumption that there would be no further compact violations after 1994.[7] Kansas experts also made the conservative assumption that the declining groundwater levels would not reduce well efficiencies, nor affect the amount of time required to pump an acre-foot of water. RT Vol. 181 at 58.

As a result of its analysis, the Kansas experts concluded that additional regional pumping costs, imposed by lower groundwater levels for the historic period 1950-94, amounted to $4,515,590. Kan. Exh. 1092, Table B5. These damages included adjusting actual historic costs for the time value of money. Such an adjustment includes inflation and prejudgment interest, or in economic terms, "opportunity costs." As to additional future costs of pumping, Kansas experts estimated damages at

[7] This assumption, we know now, is not correct. Depletions for the period 1995-96 were determined to be 7935 acre-feet. Any additional depletions have yet to be considered.

$2,061,354. Kan. Exh. 1092, Table B8. This figure represents the present value of future costs, which were estimated to be $6,576,944 in 1998 dollars. A 3 percent discount rate was used to adjust the total future costs to present value. The purpose of discounting future damages to a present value is to allow a court to award damages as a lump sum, rather than ordering a defendant to pay damages in the future as they occur. *Jones & Laughlin Steel Corp. v. Pfeifer*, 462 U.S. 523, 536-37, 76 L.Ed.2d 768, 103 S.Ct. 2541.

Lower courts have observed that awarding prejudgment interest "is just the flip side of discounting" future losses to present value. *Matter of Oil Spill by the Amoco Cadiz*, 954 F.2d 1279, 1332 (7th Cir. 1992); *In re Air Crash Disaster Near Chicago, Ill. on May 25, 1979*, 644 F.2d 633 (7th Cir. 1981); *Moore-McCormack Lines, Inc. v. Richardson*, 295 F.2d 583 (2nd Cir. 1961). Colorado discounted, and thus reduced future regional damages, but did not add interest to past damages.

Colorado also estimated damages for additional pumping costs in the regional area. For future costs, Colorado experts estimated the present value of such additional costs at $1,323,719, using a 4 percent discount rate. Colo. Exh. 1245N. For higher regional pumping costs during the historical period of 1950-98, Colorado estimated the tax adjusted loss at $1,068,460, in what Colorado described as "nominal" dollars. Colo. Exh. 1245K. Colorado used the term "nominal" dollars to represent actual costs in the year incurred, without adjustment for inflation or prejudgment interest. Colorado then converted its nominal dollar estimates to constant 1998 dollars, using a consumer price index. The result of this

calculation for historic higher costs was $1,751,187. *Id.* This value did not include any interest. In Professor Barry's judgment, the Colorado procedure merely converted "past dollars into dollars today of comparable purchasing power," but did not account for the "opportunity costs" that farmers historically had. RT Vol. 208 at 33.

The disagreements among the experts stem from: (1) their differences over variable costs, the adjustments for federal and state income taxes, and whether a further adjustment should be included for lost social security benefits; and (2) whether such losses should include prejudgment interest, or merely be brought to 1998 values. These issues are all discussed elsewhere in this Report, and the recommendations made in such sections apply to higher regional pumping costs caused by depletions of usable flow. The data in Kan. Exh. 1092, Tables B1, B2, B3 and B6 should be used in the analysis. The loss due to higher pumping costs in the future, however, involves a separate dispute over the appropriate discount rate to be used in converting estimated future costs to a present value.

A. Discount Rate for Future Regional Damages.

In determining an appropriate interest rate, both for compounding past losses and discounting the additional future costs of pumping in the region, Professor Whittlesey consulted Professor Peter J. Barry at the University of Illinois. Professor Barry is preeminent in his field of

agricultural finance.[8] In 1998, Professor Whittlesey, in the preparation of his expert report, asked Professor Barry for the "most appropriate" interest rate to bring both past and future effects to a present value. RT Vol. 189 at 71-72, 74. In regard to discounting and compounding, Professor Barry testified that both were "part of the process of adjusting for the time value of money, either bringing values ahead to a value of present or bringing future values back to a present value." RT Vol. 208 at 26.

Kansas projected future additional pumping costs in constant 1998 dollars, that is, without any adjustment for inflation. Kan. Exh. 892, Section B at 7-8; RT Vol. 189 at 61. In "economic jargon," these costs are considered "real values." RT Vol. 181 at 65-66. Real values must be discounted using a "real rate" of interest, that is, a rate which does not include inflation. RT Vol. 181 at 61, 73; RT Vol. 208 at 27-32; Kan. Exhs. 1005, 1009, 1013. *O'Shea v. Riverway Towing Co.*, 677 F.2d 1194 (7th Cir. 1982). In this

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[8] His qualifications are contained in Kan. Exh. 973. He holds an endowed chair at the University of Illinois and has been a Professor of Agricultural Finance since 1979. He is a past editor of the American Journal of Agricultural Economics, a past president of the American Agricultural Economics Association, and current Chair of the Council on Food, Agricultural and Resource Economics. He is the recipient of numerous awards, the author or a contributing author of a number of books, and his qualifications list some 14 pages of publications, including many peer reviewed journal articles, book chapters, periodical articles, technical reports, and conference papers. The book "Financial Management in Agriculture," of which he is the principal author, is in its fifth edition and is a widely used undergraduate textbook in about 50 universities.

case, Kansas experts selected 3 percent as an appropriate discount rate. RT Vol. 189 at 61-62; Kan. Exh. 892, Table B8.

Professor Wichelns, in his expert report prepared for Colorado, first used a discount rate of 7.23 percent. Colo. Exh. 1096 at 41, Table CO-B8. During the trial, he acknowledged that this was a mistake. RT Vol. 195 at 119-20; RT Vol. 210 at 30-32. He misread the fact that Professor Whittlesey had estimated future pumping costs in real dollars, absent inflation, and hence a real discount rate was appropriate. RT Vol. 195 at 119-20. Accordingly, he reduced his discount rate to 4 percent. He acknowledged that the Kansas discount rate of 3 percent was correct, but he added a 1 percent risk premium to account for the uncertainty in future agricultural prices and production conditions. RT Vol. 195 at 120-22.

Professor Wichelns cites three publications concerning uncertainty in the future of agriculture. Colo. Exhs. 1166, 1167 and 1168. These data, however, were not recent, and only Colo. Exh. 1166 relates specifically to the Kansas high plains area. That paper is a theoretical study on the impact of prices and energy costs on agricultural production. Not surprisingly, it concludes that production levels are "sensitive" to changes in energy and commodity prices. Colo. Exh. 1166 at 10. Indeed, with sufficiently low crop prices and high natural gas prices of $7.00/mcf, it found that agriculture in western Kansas "was essentially eliminated." *Id.* at 10. These were late 1980 projections, and it is worth noting that 1998 natural gas prices were only $1.20/mcf according to Colorado evidence, and $2.19/mcf in the Kansas analysis (compared to $7.00 in the study). Colo. Exh. 1096, Table

CO-A8; Kan. Exh. 1092, Table A8. But using a scenario that projected increases in both commodity prices and energy costs, the study showed little change in acreage. *Id.* Professor Barry, asked about the future of family farms, thought that the outlook was "bright" for well managed operations, and that they will "find niches in which they can continue to thrive and compete successfully." RT Vol. 189 at 88-89.

Professor Wichelns did not link the claim of uncertainty in future agriculture to any degree of probability. Nor did he support or explain his specific use of a 1 percent risk factor added to the discount rate as opposed to any other figure. The 1 percent increase, of course, has the effect of decreasing the Kansas claim. RT Vol. 181 at 76. Colorado cites *Douglass v. Hustler Magazine, Inc.*, 769 F.2d 1128 (7th Cir. 1985) for the inclusion of risk in a present value analysis. There the court rejected an economist's opinion of future earnings because he failed to adjust the discount rate for the "extreme riskiness" of the future earnings stream. Colo. Closing Br. at 67. While this case perhaps offers a refreshing departure from economic journals, the uncertainty associated with the future earnings of a nude model suing Hustler Magazine may have limited relevance in assessing the future of agriculture in Kansas. The Seventh Circuit in the *Hustler* case also noted that a discount rate, without risk and without inflation, might be as low as 2 percent. 769 F.2d at 1143.

While certainly there can be legitimate disputes over the selection of a particular discount rate, I believe that the weight of the evidence here supports the 3 percent rate used by the Kansas experts. Professor Barry, as well as Professor Whittlesey, testified that the discount rate

used was "fair and appropriate." RT Vol. 189 at 87; RT Vol. 181 at 75. Many of Professor Barry's publications deal specifically with the issue of risk. Kan. Exh. 973.

B. Conclusion.

Increased regional pump costs, both historic and future, are appropriate damages suffered by Kansas. Future cost estimates should be discounted at the 3 percent rate used by Kansas. Pumping costs should be calculated in accordance with Kansas' evidence except, as may be relevant, for any adjustments included in Section V.

SECTION VII

CROP PRODUCTION LOSSES

The largest component of the Kansas damage claim is based upon the regional loss of farm income due to surface water depletions. The claim relates to those lands irrigated by surface water only, that is, those lands within the ditch service areas that did not have supplemental wells. In 1950 those lands included approximately 29,000 acres out of a total of some 50,000 irrigated acres. By 1994, the surface water only lands had decreased to 8709 acres. Kan. Exh. 892, Section C at 4; Table C1. The number of wells increased from 282 in 1950 to 618 in 1988. Colo. Exh. 1076 at 3-4, Table 2. For the period 1950-94, Kansas asserts damages for crop losses due to depletions of Stateline flows in the sum of $45,106,973. Kan. Exh. 1092, Table C10. This total amount consists of tax adjusted on-farm losses of $4,378,342 in nominal dollars, namely, the actual dollar value of the losses in the year incurred, from 1950 to 1994, together with $40,728,631 in prejudgment interest which includes both inflation and lost investment opportunities.

Colorado did not dispute the fact that depletions of headgate deliveries to lands irrigated only by surface water "caused some reduction in income," and that crop production losses were an appropriate category of damage. Colo. Closing Br. at 98; RT Vol. 193 at 72. The amount of loss, however, was vigorously contested. Colorado estimated the actual year-to-year farm losses, adjusted for taxes, at one-third of the Kansas claim, namely $1,321,220. Colo. Closing Br. at 13. Adjusted for inflation only, Colorado put these losses at $4,091,464. Colo. Exh. 1253.

Colorado did not include any other element of prejudgment interest.

Estimating production losses was greatly aided by a number of agreements between the states. To begin with, the amount of the shortage of surface water was agreed upon. For the period 1950-94 depletions in headgate deliveries to surface water only lands totaled 72,036 acre-feet. Stipulation, Table 4B; RT Vol. 178 at 128. Of such amounts, 65% would have been consumptively used by crops. The figure of 65% is the same as the evapotranspiration (ET) rate of the crops, and the terms "ET" and "consumptive use" were used interchangeably. The remaining 35% of headgate deliveries would have been return flows, not consumed by the crops. Kan. Exh. 892, Section C at 8; Colo. Closing Br. at 71. Crop prices were agreed to, as well as the crop mix as it varied over time. Kan. Exh. 892, Section C at 7; Colo. Exh. 1096 at 58-59. The crops involved in the damage assessment were alfalfa, winter wheat, and grain sorghum (or "milo" to local farmers). The 1998 Stipulation also included the annual water requirements on an acreage basis (taking into account rainfall), and the amounts of water actually delivered. Stipulation, Table 4B, cols. e, f. For the period 1950-94, average water requirements were 2.19 acre-feet per acre, while deliveries averaged only 1.08 acre-feet. *Id.* This is a "water short" region and the shortage in meeting the full consumptive use requirements of the crops, entirely apart from the depletions, averaged 36,459 acre-feet annually. Stipulation, Table 4B, col. af. In proposing a water remedy, Colorado recognized this chronic shortage and assumed that the Kansas farmers could beneficially

use, on average, 30,000 acre-feet of additional river flows. RT Vol. 211 at 118, 121-23; Colo. Exh. 1205, Table 1.

The Kansas approach to establishing crop losses and lost income was unexpectedly simple. It rests upon the linear relationships between additional water available for consumptive use, i.e., ET, and crop yields. Up to the point where crops no longer can make use of additional water, more water produces more crop yield. Conversely, the depletions in usable Stateline flow decreased the yields of alfalfa, winter wheat and sorghum that otherwise would have been realized. Colorado experts did not dispute, in general, the linear relationship between ET and crop yield. RT Vol. 196 at 146; RT Vol. 197 at 81-82; Colo. Exh. 1085 at 5. However, they were of the view that the particular linear crop yield response coefficients used by Kansas were not sufficiently reliable to determine the increase in yields that would have occurred if there had been no depletions of headgate deliveries to the surface water only lands.

A. The Kansas Evidence Establishing Crop Losses.

The Kansas experts relied upon a number of studies indicating that the crop yield response to water is linearly related to the water consumed by the crop. Kan. Exhs. 920-21, 924-25, 927, 930, 933, 936, 964, 966-72. Colorado's expert also acknowledged that the underlying principle of a linear crop yield versus ET relationship has "long been understood." Colo. Exh. 1085 at 5. The relationship

takes the form of a simple linear equation.[9] Plotting the equation, the important coefficient is the slope, which is the incremental ratio between yield and ET. It predicts the incremental increase in yield that results from an incremental increase in ET. Thus, from the slope value one can determine how many bushels of increased yield of wheat or grain sorghum, or tons of alfalfa, would have been realized for a given amount of increase in water consumed by the plant.

Based upon various studies, and conversations with Professor Loyd Stone of Kansas State University, Professor Whittlesey adopted the following values: 0.15 tons per acre per acre-inch of ET for alfalfa; 4.5 bushels per acre per acre-inch of ET for wheat; and 9.0 bushels per acre per acre-inch of ET for grain sorghum. Kan. Exh. 892, Section C at 9. Using these values, Professor Whittlesey was able to determine what the increased crop yields would have been in the absence of depletions, and since crop prices were known, to convert the lost yield into a change in gross farm income. Harvest costs were deducted and tax adjustments made to reflect on-farm annual lost income from 1950 through 1994. Losses included deficiency payments in some years, which were not at issue.

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[9] $Y = mX + b$

Where:

Y = crop yield in units per acre

X = evapotranspiration (ET), acre-inches/acre

m = change in yield per unit of ET

b/m = threshold level of ET for crop yield to begin

1. *Alfalfa.*

The yield function for alfalfa was derived from a comprehensive report published in 1981 by Theodore W. Sammis.[10] This study was based upon five sites in New Mexico, but earlier studies in Nebraska, North Dakota and Nevada were also reviewed in this report. Kan. Exh. 933. The study concludes that alfalfa yield is a "linear function of evapotranspiration," and yield functions averaged 0.1571 tons per acre per acre-inch. Kan. Exh. 933 at 324; Kan. Exh. 963 at 2. Professor Whittlesey in his calculations used a yield function of 0.15. The research reported in the Sammis paper was conducted making water the only variable in controlling growth. Kan. Exh. 933 at 323. Different amounts of water were supplied to create "various levels of water stress." *Id.* at 324. The consistency of the New Mexico results, compared with studies from other states, showed that the "relationship between alfalfa growth and evapotranspiration is independent of where the alfalfa is grown." *Id.* at 328; RT Vol. 187 at 78-80. The Sammis results were later confirmed in a paper published by Marvin E. Jensen reporting on studies in California, Idaho, New Mexico, North Dakota and Nevada. The composite alfalfa yield function from the Jensen paper was 0.1961 tons per acre per acre-inch. Kan. Exh. 963 at 2, Table 2.

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[10] "Yield of Alfalfa and Cotton as Influenced by Irrigation," published in the Agronomy Journal, Volume 73, March-April 1981. Kan. Exh. 933.

The 0.15 value used by Kansas for alfalfa was not accepted by Colorado, but neither was it seriously challenged by Colorado experts in the same way they disputed wheat and sorghum values.

2. *Winter Wheat and Grain Sorghum.*

About two years before this trial segment of the case, while Professor Whittlesey was preparing his basic report for Kansas, he consulted with Professor Loyd R. Stone of Kansas State University.[11] Professor Whittlesey's initial call related to a 1995 publication of which Professor Stone was the lead author. Kan. Exh. 934. Professor Whittlesey had three questions for Professor Stone: (1) whether the crop-ET relationships for wheat and sorghum were indeed linear; (2) whether the slope values in Stone's 1995 publication were appropriate for estimating long-term crop yields (RT Vol. 206 at 107; Kan. Exh. 934 at 14); and (3) if not, what the values should be. RT Vol. 206 at 109. Professor Stone replied in the affirmative to the first

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[11] Professor Stone was later called as a rebuttal witness. His qualifications appear in Kan. Exh. 1081. He has been a Professor of Agronomy at Kansas State University since 1983, and is a Fellow of the American Society of Agronomy. About 90% of his time has been devoted to research, and much of this has been done at Tribune, Kansas, which is immediately north of the ditch service area and Hamilton County. RT Vol. 206 at 94, 100-101. His work has been focused primarily in the areas of soil physical properties and the efficient use of water, including the crop yield response to limited irrigation. His publications include 48 technical, refereed papers, a number of which deal specifically with the crop yield-ET relationships at issue in this case.

question, but in the negative to the second. *Id.* at 107-09. The values in his 1995 publication were 6.03 for winter wheat and 12.20 for grain sorghum which reflected the results from test plots. In answer to the third question, Professor Stone recommended that the test plot data be reduced by about 25%, that is, to 4.5 for wheat and 9.0 for sorghum. *Id.* at 109. These were the values that Professor Whittlesey then used in his expert report. Kan. Exh. 892, Section C at 9. The 25% reduction was calculated to adjust the controlled experimental data to "realistic long-term type conditions" in western Kansas, including high temperatures, winds, insects, and other stressful conditions. RT Vol. 206 at 129-30; see also RT Vol. 181 at 105-09.

Much of the research on the yields of wheat was done by or under the supervision of Professor Stone at Tribune, Kansas. His values were supported by data from both dry land and irrigated studies. The dry land studies extended over the period 1973-88. RT Vol. 206 at 120; Kan. Exh. 1071, Table 6 at 359; Kan. Exh. 1082, Table 1. Irrigated studies were conducted during 1977-79, and the results published in a peer-reviewed journal. RT Vol. 206 at 122-23; Kan. Exh. 1072, Table 5 at 635. The crop-ET relationship recommended by Professor Stone, and used by Kansas, is also supported by United States Department of Agriculture studies. Kan. Exh. 1083; Kan. Exh. 969, Figure 1 at 982. One of these studies performed at the USDA research facility in Bushland, Texas, extended over the period 1978-92 and involved fourteen irrigated fields, as well as dry land test data from 1958-91. Kan. Exh. 969 at 981-82; RT Vol. 207 at 20-24.

3. *Grain Sorghum.*

Grain sorghum studies were also conducted at Tribune, Kansas. These too included dry land studies, that is, relying upon rainfall only without irrigation, over the period 1973-88. RT Vol. 206 at 112-13; Kan. Exh. 1071, Table 8 at 360; Kan. Exh. 1082, Table 2 at 5. They also included irrigated studies conducted at Tribune during the period 1974-87. These were published in a peer-reviewed journal in which Professor Stone again was the lead author. RT Vol. 206 at 115-17; Kan. Exh. 936, Table 3 at 255. The linear crop yield-ET relationship, and value, established by these studies were also supported by a 1961 United States Department of Agriculture publication. Kan. Exh. 1047.

B. Colorado's Alternate Approach.

Colorado's experts vigorously disputed the Kansas analysis with respect to wheat and grain sorghum. They argued that the data from the various controlled experiments could not be used to predict yields under actual field conditions; that the study data did not take into account the timing of water applications; and that the experiments did not capture the variability caused by insect damage, hail storms, and other weather events. Moreover, Professor Wichelns testified that the fundamental assumption of the Kansas analysis, namely, that these crops could always use more water, was "totally

unreasonable."[12] Colo. Exh. 1096 at 59. He found the results of the Kansas analysis to be "completely unrealistic," and therefore he developed "an alternate approach" to predict crop losses resulting from depletions of usable flow from the Arkansas River. Colo. Exh. 1096 at 59-65, 73-86.

In his own analysis, Professor Wichelns constructed yield equations for different seasons to address the variability associated with the timing of water use. His equations also included a "random shock term" which was intended to capture the impacts of insect damage and weather events. RT Vol. 197 at 42-44. This was an estimated factor that did not come from any reported values. *Id.* at 50. The data used in Professor Wichelns' yield equations came from a 1962 unpublished Ph.D. dissertation by Amar Singh Sirohi. Colo. Exh. 1114; RT Vol. 196 at 74-75. The Sirohi data included both crop yields and the amount of water applied or available in specific months. Of significance in this case, the sources of water included not only irrigation deliveries, but also rainfall and preseason moisture. Colo. Exh. 1096 at 76.

Most of the data collected by Sirohi came from the Garden City experiment station, although some data were merely the result of a mail survey. RT Vol. 196 at 81-82. Professor Wichelns was unable to reproduce the Sirohi production functions from the data used, but nonetheless he continued to use the data, and developed his own functions. RT Vol. 196 at 82-85. However, after a day of

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[12] In its Closing Brief, however, Colorado states, "The ditches in Kansas were very water-short with or without depletions to Stateline flows." Colo. Closing Br. at 108.

cross-examination, Professor Wichelns acknowledged that the data were "not reliable" for the purposes for which he used them, and that unfortunately his approach had not worked out. RT Vol. 197 at 44-46. Kansas moved to strike this portion of his expert report, and in its Closing Brief, Colorado acknowledged that Professor Wichelns withdrew his analysis because the data on which he relied were "not appropriate." RT Vol. 197 at 68-69; Colo. Closing Br. at 78.

The problem with Professor Wichelns' analysis, however, runs deeper than merely the data involved. The Sirohi yield figures clearly involved available water supplies in excess of the ET or consumptive use requirements of the crops. Excess water becomes runoff and does not contribute to crop yield. RT Vol. 196 at 131, 140. Kansas introduced several exhibits comparing the consumptive use requirements of the Sirohi crops with the actual water supply made available. Kan. Exh. 1049, 1050, 1051*. In almost all of the Sirohi experiments, substantial amounts of extra water were available. RT Vol. 196 at 132, 136, 138; RT Vol. 197 at 9, 11-12, 17-18. Yet in attempting to plot the relationships between consumptive use and the yields for alfalfa, wheat and sorghum, Professor Wichelns plotted *all* of the data points, including those showing no change in yield because of the excess water. RT Vol. 196 at 142-44; RT Vol. 197 at 14-17. Professor Wichelns had to acknowledge that the Sirohi data were not representative of water short conditions, and to the extent that water is applied when the crop has a full supply, there is no increase in yield. RT Vol. 196 at 143; Kan. Exh. 1002 at 27. The data plotted in excess of the ability of the crops to use water affected both the shape and values of the equations

developed by Professor Wichelns. Yet he still sought to apply those data "to strictly consumptive use supplies." RT Vol. 197 at 34.

C. Colorado's Objections to the Kansas Analysis.

One of Colorado's expert witnesses was Grant E. Cardon, Associate Professor, Department of Soil and Crop Sciences, at Colorado State University.[13] Professor Cardon believed that the Kansas analysis results in a "significant over-prediction of yield losses" due to the depletions of usable Stateline flows. Colo. Exh. 1085 at 12. He emphasized two primary reasons for this opinion: (1) the linear crop yield-ET relationships on which the Kansas experts rely were developed under highly controlled, homogenous conditions that do not apply under average farm conditions; and (2) the crop yield-ET test data do not reflect the differences in yield that depend upon when water is applied during growth stages. Colo. Exh. 1085 at 5, 7-10.

In his expert report, Professor Cardon does not acknowledge that Professor Stone, in his first conversation with Professor Whittlesey, recommended that the test data values be reduced by approximately 25 percent to account for average field conditions. Nor does Professor Cardon in his testimony explain why the 25 percent

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[13] His qualifications are found in Colo. Exh. 1084. His B.S. degree is in agronomy; his Ph.D. degree in soil science. He has been at Colorado State University since 1992, and has published a number of refereed journal articles.

adjustment is not appropriate to account for the difference between controlled experimental data and its application in the field. RT Vol. 192 at 51-69; see also RT Vol. 181 at 104-09. The results of the various studies, reduced by approximately 25 percent, were in fact the values used by Professor Whittlesey in his analyses for Kansas.

Professor Stone, who made these recommendations, has 25 years of experience in the farm lands of Kansas affected by the depletions; he has been personally involved in much of the research; he has outstanding academic credentials; and he has to his credit a long list of peer-reviewed publications which deal with some of the specific issues in this case. RT Vol. 207 at 26; Kan. Exh. 1081. But of special importance, Professor Stone rendered his opinions long before this segment of the trial began, and outside of a litigation context. Kansas did not include him originally as an expert witness. He was called in rebuttal only after Colorado experts aimed criticism at his work. As a rebuttal witness, and despite vigorous cross-examination, his opinions were unshaken, namely, that the ET crop yield relationships for winter wheat and grain sorghum are linear, and that the values used by Kansas are appropriate for average farm conditions within the ditch service areas. I believe that Professor Stone's testimony is entitled to great weight. It should also be noted that neither Professor Wichelns nor Professor Cardon could cite to anything in the literature to support their views that the many crop yield-ET studies were not applicable under field conditions. RT Vol. 192 at 13; RT Vol. 197 at 101-02.

The values used by Professor Whittlesey were also supported by the testimony of C. Eugene Franzoy, an agricultural engineering expert with wide experience in the area of crop yield response to water.[14] Kan. Exh. 963; RT Vol. 187 at 67, 78, 87, 90-91, 99.

As to the issue of timing, many of the studies plainly timed irrigation applications over various stages of plant growth, also with different amounts of water. Kan. Exh. 969; RT Vol. 197 at 75-77. Dry land studies, of course, by their very nature depend upon rainfall only, and receive water – or a lack of water – at all stages of plant growth. Grain sorghum studies showed no significant difference in yield, whether water was applied "at boot or at bloom or at soft dough" stages. Kan. Exh. 936, Table 3 at 255; RT Vol. 207 at 123. Though water came at different times and in different amounts, sometimes applied deliberately to evaluate water stress, the linear relationships held up.[15]

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[14] Mr. Franzoy qualified as an expert previously during earlier phases of the trial. Kan. Exh. 785. He has provided expert irrigation and water resources management services in connection with numerous water projects, water rights lawsuits, legislation, Indian tribal claims, and planning studies. He assisted New Mexico in the Texas litigation on the Pecos River.

[15] This colloquy with Professor Wichelns bears on the issue:

"[MR. DRAPER] Q. So isn't it fair to say that the linear relationship shown in Figure 1 is independent of timing considerations within the season?

A. No, sir, not at all. We've just discussed that these data have been generated by looking at timing issues. Hence, these data points are not generated independent of timing issues.

Kan. Exh. 936; RT Vol. 207 at 123; Kan. Exh. 969, Fig. 1 at 982; RT Vol. 206 at 113-14; RT Vol. 207 at 22.

SPECIAL MASTER: But isn't the point that they still turn out to be linear?

THE WITNESS: I'm sorry, Sir?

SPECIAL MASTER: Isn't the point that, even though there's different timing – they're done without respect to critical timing and so forth – they all still turn out to be linear? Isn't that the point of this?

THE WITNESS: I guess the point, if I understand the point, is that there's a scatter of data points generated here as a result of the experiments, and then the experimenters estimate a linear relationship.

SPECIAL MASTER: Well, this paragraph on page 981 [Kan. Exh. 969] appears to say that sometimes they gave the plant water when it needed it, sometimes when it didn't, sometimes at one growth cycle, sometimes at another, all reflecting different timing patterns, but the results still turn out to be linear.

THE WITNESS: Yes, that appears so, your Honor. But I might note that in this description we just read, there are some methodological issues in these experiments such as irrigating to establish maximum yields, such as selecting particular times at which to stress or not to stress the plants.

I don't know if I would want to conclude from this that the variability observed in true production conditions would provide a similar scatter because, nonetheless, there is still an experimental design behind these data that may not reflect the production conditions.

SPECIAL MASTER: Well, I understand that. But this does apparently reflect – Figure 1 apparently does reflect the results of some applications that had a lot of variability in them and some different kinds of timing?

THE WITNESS: I believe so." RT Vol. 197 at 77-78.

There is no question but that the timing of *applied* water makes a difference in crop yields. Farmers try to schedule irrigation at times when the crops need water, when it will do the most good. However, the timing of applied water is not the same as timing effects on the relationship between consumptive use and yield. RT Vol. 187 at 81. Water may be available at the best of times, or at the worst of times, and the crop yield certainly may be affected by that timing. However, whenever water is applied, more water will still result in more yield, so long as there is an ET deficit. Nor did Colorado explain why plot studies that were exposed to normal weather conditions did not reflect the impact of insects, hail, wind and frost.

On redirect examination, Professor Wichelns expressed a number of new opinions, highly critical of the Kansas analysis, opinions that were not included in his original expert report. Colo. Exh. 1096. He contended that the crop-ET relationships used by Kansas were not based upon standard regression analysis techniques, and that the equations were not valid for purposes of predicting crop yield as a function of ET. RT Vol. 210 at 123, 152 *et seq*. These were highly technical issues. It is perhaps sufficient here to state that the Colorado criticisms were substantively refuted by Professor Stone when he was called as a rebuttal witness.

D. The Lack of Wells.

Professor Wichelns prepared an analysis of crop income during the 1950s and 1960s, together with the costs of drilling and operating wells. Colo. Exh. 1096 at 93-98. He concluded that during this period of time the increases in expected revenue resulting from supplemental wells would have exceeded their costs "by a considerable margin." *Id.* at 97. In his opinion, "reasonable farmers" would have made investments in wells rather than relying solely upon limited and uncertain surface water supplies. *Id.* at 97. Another Colorado expert, Professor Richard Adams, was of the same view. Given the value of water implied by the Kansas experts, which was many times higher than the cost of pumping, Professor Adams testified that he would "expect every acre of farm land to be irrigated by wells." Colo. Exh. 1203 at 8. The inference to be drawn from the lack of wells, according to these experts, is that Kansas overestimated crop losses and the value of surface flows. It should be noted, in passing, that beginning in early 1977 the drilling of new wells within the ditch service areas was restricted. RT Vol. 35 at 124-25; Jt. Exh. 82.

Given the hindsight of present day economists, it might have been profitable for everyone to drill supplemental wells in those early years. However, there are many reasons why this may not have been done, and the failure to drill wells does not by itself indicate that Kansas' estimate of crop losses is too high. The favorable economics of drilling wells may not have been understood at the time. Quality information regarding costs and returns was not readily available. RT Vol. 211 at 31.

Some farmers, for reasons of age or otherwise, may not have wanted to go into long-term debt. Some farmers may not have had the available capital, or the credit to borrow. Many farmers were "cash poor." *Id.* at 32. Some farmers may have been averse to risk. Some farmers may have been tenants, and the landlord may not have been willing to undertake the necessary investment. Some farms may have been small in terms of total acreage, or the acreage spread out over space, so that it was not feasible or practical to consider a well investment. RT Vol. 208 at 37-39. Capital for well investments, with three to ten year repayment periods, was less available than for long-term investments. RT Vol. 211 at 32.

Given the perceived economic benefits of supplemental wells, Professor Wichelns concluded that it was "very unlikely," indeed, that farmers continued to produce crops on the surface water only lands during the 1960s and 1970s. Colo. Exh. 1096 at 97. But this conclusion is contrary to the Stipulation between the parties. The November, 1998 Stipulation was based upon the Garden City study by the Kansas Division of Water Resources in 1988, and finds that some 17,000 acres of land were still irrigated during the 1970s by surface water only. Colo. Exh. 1096 at 53-54.

E. Implied Value of Water.

One of Colorado's principal experts was Professor Richard M. Adams of Oregon State University.[16] Professor Adams prepared a short expert report for Colorado assessing the value of the water estimates implied in the Kansas expert reports. Colo. Exh. 1203. Professor Adams calculated an acre-foot value for the surface water depletions by dividing the depletions for a year into the value of crop losses claimed by Kansas for that year. Colo. Exh. 1203 at 5. As a result, for the 1950-94 period, he estimated that the average value of water implied by the Kansas analysis was $65 per acre-foot in nominal dollars. Colo. Exh. 1203, Table 2. Adjusted to 1994 dollars, by an index of prices received by farmers, the value is $109 per acre-foot. *Id.*

Professor Adams then compared this implied value of depletions in Kansas with the marginal values of water for specific crops found in a search of the relevant literature. The results are summarized in Colo. Exh. 1203, Table

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[16] Professor Adams' qualifications are found in Colo. Exh. 1202. He has been a Professor of Agricultural and Resource Economics since 1983. He has more than 200 books, chapters in books, journal articles and papers to his credit. His work includes a broad range of consulting assignments, including work for the U.S. Environmental Protection Agency, and a study of the economic concepts involved in valuing groundwater for the National Academy of Sciences. Professor Adams has also served as co-editor of the American Journal of Agricultural Economics, was an associate editor for water resources research, and was on the editorial board of the Journal of Economics and Management.

1, and show prices not only for alfalfa, wheat and sorghum, but also for cotton, sugar beets, lettuce, carrots and vegetables generally. Adjusted to 1997 dollars, the values range between $10 and $455 per acre-foot. Colo. Exh. 1203, Table 1. From his literature review, Professor Adams concluded that the values implied by the Kansas analysis were unreasonably high, and that the damage claims for crop production losses should be reduced by two-thirds to three-fourths. Colo. Exh. 1203 at 8.

On cross-examination, Professor Adams categorized the literature values into either short-run or long-run situations. RT Vol. 200 at 105-125. Loosely put, the distinction appears to rest upon what fixed or development costs may be included in the transfer. The important point here, however, is that none of the literature values reported by Professor Adams dealt with what was termed a "short-short run" situation, that is, an intra-seasonal transaction in which no capital costs were involved, and only additional harvesting and irrigation costs would be required. Professor Adams acknowledged that the Kansas analysis did indeed involve such a short-short run situation, and that the literature values he reported were not "comparable to the values that are relevant in this case." RT Vol. 200 at 120-121; RT Vol. 208 at 97. The short-short run or intra-seasonal values would generally be higher than the values of water in the reported short-run or long-run situations. RT Vol. 200 at 111, 114. Moreover, there was evidence of a recent two-year transfer of water between the Palo Verde Irrigation District and the Metropolitan Water District in California at $143 per acre-foot. Kan. Exh. 1089; RT Vol. 211 at 95-96. James Lochhead, the former Director of the Colorado Natural Resources

Department, appearing for Colorado on the possible water remedy in this case, testified that the cost of acquiring water in the Arkansas Basin might be higher than the $143 per acre-foot figure used in the California transfer.

F. Conclusion.

The regional loss of farm income due to depletions of usable Stateline flow is an appropriate element of damage. The crops grown within the ditch service areas are water short, and the Kansas analysis is a reasonable method of estimating the reduction in crop yield and the loss of gross farm income due to the depletions. The results of the Kansas analysis should be used, except that additional labor costs to be deducted should be consistent with Section V.

SECTION VIII

SECONDARY ECONOMIC DAMAGES

The Kansas claim includes secondary or indirect losses to the economy of the state as a whole. These are damages that result from the direct impacts of depletions of usable Stateline flows, namely, crop losses and increased pumping costs within the ditch service areas, and additional regional pumping costs caused by lower groundwater levels. If any change is made in these direct impacts, the secondary damages will also be affected. Kansas estimates its secondary economic losses at $3,793,486. Kan. Exh. 1092, Table D6. This amount includes both historic and projected future damages, each brought to a 1998 dollar value, and includes prejudgment interest for the historic period of 1950-94.

Colorado does not have an estimate of secondary damages. While Professor Wichelns acknowledges that "there may have been some secondary economic effects" due to depletions of surface supply, he believes they would have been "very, very small." RT Vol. 193 at 81. In his opinion, there is no method to estimate such effects accurately, and they should not be addressed. *Id.* at 97.

Kansas employed two specialist experts to assist in calculating secondary damages, Professor Joel R. Hamilton and Dr. M. Henry Robison. Both hold impressive credentials.[17] Colorado chose not to engage a separate

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[17] Hamilton's qualifications are found in Kan. Exh. 938. He is a Professor of Agricultural Economics and Statistics at the University of Idaho; has international experience in China, Sri Lanka, Pakistan, India, Eastern Europe, and Australia. He

expert for secondary damages, and Professor Wichelns who was Colorado's chief economic expert on all other issues had only limited experience with input-output models. Rather, Colorado chose to rely primarily on vigorous cross-examinations of Professor Hamilton and Dr. Robison, and upon a legal objection made to all of Kansas' expert testimony on secondary economic impacts,

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testified for the State of New Mexico on secondary economic damages in *Texas v. New Mexico*. He has written numerous peer reviewed articles on secondary economic impacts, many of which involve the kinds of issues present in this case. Most recently, as Chair of the Independent Economic Analysis Board of the Northwest Power Planning Council, he provided technical review and oversight of the economic studies on proposals to "breach" four dams on the lower Snake River. These studies are being conducted by the U.S. Army Corps of Engineers as part of a potential salmon recovery project. Breaching the dams would essentially eliminate water storage, and reduce the water supplies for agriculture and hydro power. RT Vol. 206 at 33-34. The input-output model being used to assess secondary economic impacts from these proposals is IMPLAN, the same model used by Kansas experts in this case, and the model looks 100 years into the future. Kan. Exh. 1084; RT Vol. 206 at 35-36, 72-73.

Dr. Robison is President of Economic Modeling Specialists, Inc. His qualifications appear in Kan. Exh. 961. He is the person who constructed the regional IMPLAN model used in this case to assess secondary economic impacts in Kansas. He has constructed hundreds of IMPLAN models for the U.S. Forest Service and for the Department of Commerce, and currently has a major assignment for the Federal Highway Administration. He has also assessed secondary economic impacts, using IMPLAN, for the States of Idaho, Utah, Colorado and New Mexico, and for many cities and regional governmental agencies. His writings in peer reviewed journals address many of the issues involved in this case.

based upon the standards in *Daubert* and *Kumho Tire Co.*[18] The Colorado objection was overruled by written Order dated May 1, 2000, and included as Exhibit 8 in the Appendix.

In assessing secondary impacts to the economy of Kansas as a whole, the Kansas experts used an input-output form of analysis that is generally recognized in the field of economics. Specifically, they employed an input-output model known as IMPLAN. This is a national level model originally developed by the U.S. Forest Service and now maintained by the Department of Commerce. Kan. Exh. 892, Section D at 5; RT Vol. 186 at 57, 61-62. It has now been coupled with county level economic data made commercially available by the Minnesota IMPLAN Group, located at the University of Minnesota. Kan. Exh. 962, RT Vol. 186 at 59. Dr. Robison, personally, has constructed hundreds of IMPLAN models to assess secondary economic impacts for various departments of the federal government, for several states, and for numerous local agencies. RT Vol. 186 at 50-52; Kan. Exh. 961. IMPLAN is the "most widely used" model for assessing secondary economic impacts. RT Vol. 185 at 80; RT Vol. 186 at 26. More information on input-output modeling appears in my Order on Colorado's *Daubert* motion, included as Exhibit 8 in the Appendix.

Dr. Robison constructed the model used by Kansas in this case. It traces the ripple effects of the depletions

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[18] *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 125 L.Ed.2d 469, 113 S.Ct. 2786 (1993); *Kumho Tire Co., Ltd. v. Carmichael*, 526 U.S. ___, 143 L.Ed.2d 238, 119 S.Ct. 1167 (1999).

within the ditch service areas, and upon the adjacent region, throughout the statewide economy. Some of these impacts are regarded as "gains" while some are "losses." Increased pumping expenses and less net farm income within the ditch service areas are adverse to one sector of the economy, but advantageous to the segment that profits from increased well pumping.[19] The model determines the net effects, and in this case calculates, overall, net losses to the Kansas economy. Kan. Exh. 892, Section D at 9-12; RT Vol. 206 at 16-17. A summary of the gains and losses appears in Kan. Exh. 1092, Table D6.

It is ironic that professional economists treat the economic activity associated with the additional use of groundwater, that is, with a permanent exhaustion of a natural resource, as an economic "gain" which is to be offset against an acknowledged "loss" of net farm income. Nonetheless, this appears to be an accepted practice, and in this case represents a conservative approach to Kansas' damages.

Secondary economic impacts are also affected by a concept known among economists as "opportunity costs."[20] This term refers to the "next best alternative employment of a resource," and is a method for reducing

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[19] Dr. Robison testified, "It's the old irony with economists. Even a tornado benefits windowpane sellers. And there's no doubt that if you deprive the Kansas economy of water, you'll benefit pump dealers." RT Vol. 186 at 120.

[20] This is slightly different from the use of the term in connection with prejudgment interest, where it relates to the investment opportunities of funds which a person should have had.

gross secondary impacts to the net gains or losses affecting an economy. RT Vol. 185 at 131, 144. In this case, the Kansas experts determined that opportunity costs offset all but 20 percent of the secondary impacts. That is, 80 percent of secondary impacts were assumed to represent factors moving to or from the next best opportunities elsewhere in the economy. Kan. Exh. 892, Section D at 7. Only 20 percent of the total secondary impacts were counted as net gains or losses. *Id.*; RT Vol. 185 at 124. Some economists have argued that this is "too restrictive," and that a larger percentage should be used to determine net secondary impacts. Kan. Exh. 947; RT Vol. 185 at 116-18.

On cross-examination, however, Colorado suggested that the 20 percent factor should be lower, or at least that it was not proven with reasonable certainty. Colorado offered no figure of its own. While the 20 percent factor is based upon the analyst's judgment, there is ample evidence to support its use. RT Vol. 206 at 88. The seminal work on the subject is a book by Haveman and Krutilla evaluating opportunity costs for the kinds of resources used in water projects. Kan. Exh. 949; RT Vol. 185 at 105. Their study involved some 100 projects in all parts of the country. RT Vol. 185 at 105-108. Opportunity costs ranged from 69 to 94 percent; that is, net secondary impacts fell between 6 and 31 percent. Kan. Exh. 949, Table 21; RT Vol. 185 at 147. Support for 20 percent can also be found in *Texas v. New Mexico*, where experts for both states used 20 percent (RT Vol. 185 at 120; RT Vol. 206 at 24); the Colorado-Big Thompson project, 20 percent (RT Vol. 185 at 131); the State of Washington study in regard to a prohibition on grass seed burning, low of 20 percent (Kan. Exh.

1085; RT Vol. 186 at 33); Bergmann and Boussard international study in France, 10-20 percent (Kan. Exh. 1004; RT 206 at 9-10); Bureau of Land Management Study on making additional land available for agricultural irrigation, 10-20 percent (Kan. Exh. 944; RT Vol. 185 at 96).

In the final analysis, Colorado argues that the Kansas evidence on secondary economic impacts is not sufficiently reliable or certain to support a damages award. Colo. Closing Br. at 102. It is true that the Kansas damage claim is an estimate, and involves the judgment of its experts. But the law does not require that scientific testimony be known "to a certainty." *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 125 L.Ed.2d 469, 113 S.Ct. 2786 (1993). Although "good grounds" must support an expert's testimony, the process followed is also important. *Id.* at 590. Here, the Kansas experts used a methodology, and a specific input-output model, that have been "widely adopted and widely accepted" for measuring secondary economic impacts, and constitute the "most reliable" approach that can be used. RT Vol. 186 at 26; RT Vol. 187 at 50; RT Vol. 206 at 10-11; Kan. Exh. 1010. The Kansas experts testified that the results provide a "reasonable estimate" of secondary impacts and a "reasonable quantification" of damages. RT Vol. 206 at 16, 38; RT Vol. 187 at 50-52. The very input-output model, and the very people, used by Kansas to assess secondary impacts here are currently being used extensively by the federal government for the same purpose. The approach of the Kansas experts was conservative and professional. We can anticipate that their testimony will be carefully examined in the profession because of the time span over which the input-output analysis has been used. However,

there is now evidence the Corps of Engineers is using IMPLAN to look ahead 100 years. Kan. Exh. 1084; RT Vol. 206 at 35-36, 72-73. And current models are much more accurate than those used even ten years ago. RT Vol. 187 at 37.

A. Conclusion.

I find that the weight of the evidence supports the Kansas claim for secondary economic damages. They may have to be recalculated, depending upon any revisions to the underlying damages, but the methodology used by the Kansas experts should be employed in making any such final damage estimates.

SECTION IX

FEDERAL AND STATE INCOME TAXES

Kansas reduced its damage claim to account for federal income taxes that would have been paid on increased farm net income. Kansas experts reasoned that without depletions of Arkansas River water, the net income of farmers would have been greater, but a portion of that increase would have been paid to the federal government in taxes. The federal share would not have been a loss either to the farmers or to the State of Kansas, and so it was deducted from Kansas' damages. Colorado acknowledged that the higher the marginal rate that was used to estimate taxes, the lower would be the Kansas damages. RT Vol. 195 at 80. Not surprisingly, Colorado agreed with this approach. Kansas pointed out, however, that no such adjustment had been made by either state to the damage claims in *Texas v. New Mexico*. RT Vol. 203 at 28.

State income taxes were treated differently. These taxes, which would have been paid absent depletions, were considered to be a direct loss to the State of Kansas, and are included in its damage claim. Kan. Exh. 892, Section A at 26, Table A11. While Colorado took issue with the amount of foregone state taxes, it did not contest such loss as a component of damages.

A. Federal Marginal Tax Rates.

The states were in agreement that the federal tax adjustment should be made on the basis of marginal tax rates, not on average rates. The experts also agreed, by

the end of the evidentiary proceedings, that it is appropriate to reduce the statutory marginal rates to account for the tax management opportunities available to farmers. RT Vol. 195 at 86-87. These options include income averaging, loss carryover, investment credits, cash vs. accrual accounting, payment of salaries to family members, shifting income or expenses from one tax year to another, and depreciating or expensing capital items. Professor Wichelns did not adjust for these opportunities in his original report, but he came to accept a 15 percent reduction in the statutory marginal rates as being reasonable. RT Vol. 195 at 86-87; RT Vol. 199 at 87-88; Kan. Exh. 1075. Kansas had used a 15 percent adjustment from the outset. Kan. Exh. 892, Section A, at 23.

For much of the historic period in question, there was also agreement on the particular marginal tax rates to be used. The experts for the states agreed upon rates for the period 1950-66, and for 1985-96. Colo. Exh. 1148; RT Vol. 195 at 78. The disagreement was limited largely to the period 1970-84. RT Vol. 195 at 78; Kan. Exh. 892, Table A10; Colo. Exh. 1096, Table CO-A10. During the disputed period, Kansas rates (not including the 15 percent adjustment) remained largely at 19 percent. The rates used by Professor Wichelns for Colorado were mostly at 28 percent, but reach 40 percent in one year. Colo. Exh. 1148. Detailed tax information is not easy to obtain, even for experts, and both states attempted to find ways to estimate, on average, the net farm income and appropriate marginal tax rates applicable to the farms affected by the depletions of usable Stateline flow. I accept the use of averages, based upon the best data available, as the only

practical way to estimate the federal tax reduction to Kansas' damages.

Concentrating on the evidence for the 1970-84 period at issue, Professor Whittlesey relied upon data from two studies of Minnesota farms,[21] certain national farm and IRS statistics, conversations with several farmers within the ditch service areas, and the tax returns of one "representative" farmer. Kan. Exh. 907, 908; RT Vol. 183 at 74-79, 85-86; Kan. Exh. 898, Fig. A-3; RT Vol. 203 at 67-68. The tax returns of the "representative" farmer were used primarily for the earlier 1950-68 period, after which he was no longer a full-time farmer. RT Vol. 183 at 83-86; RT Vol. 203 at 67. Colorado's expert, Professor Wichelns, also relied upon the tax returns of this representative farmer for the 1950-66 period when he and Professor Whittlesey were in agreement. RT Vol. 198 at 115. Professor Whittlesey had localized data available from the Kansas Farm Management Association annual reports, but he did not initially derive his values from those data because of the way in which income was reported. RT Vol. 183 at 80-82, 88; RT Vol. 203 at 68. The Minnesota studies covered the periods 1967-78 and 1977-82, and involved 76 farms during the first study and 163 farms during the later period.

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[21] These were studies by Gregory D. Hanson and Vernon R. Eidman entitled "Agricultural Income Tax Expenditures – a Microeconomic Analysis" and published by the American Agricultural Economics Association (Kan. Exh. 907), and "Evidence of the Stability of Income Tax Expenditures to Farmers" published in the Agricultural Finance Review (Kan. Exh. 908).

RT Vol. 183 at 76-77; Kan. Exh. 908 at 71. Professor Whittlesey's conclusions, which he acknowledged were a matter of judgment, are found in Kan. Exh. 892, Table A10;[22] RT Vol. 183 at 88-89.

Professor Wichelns, for Colorado, testified that he relied upon the tax returns of four farmers in the ditch service areas,[23] and upon information in the Kansas Farm Management Association reports.[24] RT Vol. 195 at 69-73. Professor Wichelns disagreed with the sources of data used by Professor Whittlesey to estimate marginal federal income taxes because, he testified, "we have better sources of data available," pertinent to farmers in southwest Kansas. RT Vol. 195 at 67-68. I do not agree that the data used by Professor Wichelns are better, nor that his methodology produces a more appropriate estimate of federal marginal taxes paid.

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[22] These calculations were later revised to reflect corporate tax rates for the Garden City Company. Corporate rates are higher than individual marginal rates. RT Vol. 183 at 93-94, 96.

[23] To protect the confidentiality of these farmers' tax returns, they were designated merely as Farmers A, B, C and D. See Colo. Exh. 1148.

[24] The Kansas Farm Management Association is a membership organization that assists farmers in collecting and analyzing information on the financial performance of their farm operations. RT Vol. 193 at 147. The state association is divided into geographic regions. "Association No. 3" covers 23 counties in southwest Kansas and includes Hamilton, Kearny and Finney Counties. The Association report for 1972 shows 604 farm members in Association No. 3, of which 101 are located in Hamilton, Kearny and Finney Counties. Colo. Exh. 1154. There is no breakdown as to how many of these farms lie within the ditch service areas.

To begin with, of the four farmers relied upon by Professor Wichelns, only Farmer A's tax returns covered the whole period in question, while Farmer B's returns included about one-half of the period. The tax returns of the other two farmers essentially related to the earlier years when there was no disagreement with Kansas. There was no evidence to show that the marginal tax rates paid by Farmers A and B could reasonably be used to represent taxes paid over the whole ditch service area. Indeed, the evidence indicates the contrary, and it is questionable whether even these two farmers paid the marginal rates assigned to them by Professor Wichelns. His methodology was explained with reference to Farmer B for the year 1972. Professor Wichelns' spreadsheet showed "taxable income" for Farmer B in 1972 of $38,557. Kan. Exh. 1058. He then went to a table of statutory marginal tax rates for various levels of "adjusted gross income." Colo. Exh. 1147. These marginal tax rates are also shown on a table published by the U.S. Treasury Department which relates adjusted gross income to average and marginal tax rates. Kan. Exh. 1056; RT Vol. 198 at 121. Looking at this table in the column for adjusted gross incomes between $35,000 and $50,000, for a married couple with two dependents, one reads across the table to find a marginal tax rate of 40 percent for the year 1970. RT Vol. 198 at 121. This is how Professor Wichelns concluded that Farmer B was subject to a marginal tax rate of 40 percent in 1972, as reflected in Colo. Exh. 1148. Yet according to the Treasury Department table, a 40 percent marginal rate would equate to an average tax rate of 21.9 percent, and Professor Wichelns' own spreadsheet shows

that the average tax rate paid by Farmer B was only 14.67 percent. Kan. Exhs. 1056, 1058.

For the year 1972, however, Professor Wichelns actually adopted a marginal tax rate not of 40 percent, but 33 percent because of other Kansas Farm Management Association data. RT Vol. 199 at 94-95. Yet in the following year, 1973, he jumped the marginal tax rate to 40 percent, though his rates for Farmers A and B remained the same in both 1972 and 1973. Colo. Exh. 1148. The Kansas Farm Management Association report for 1973 shows that an average farm family in the southwest portion of Kansas paid only $2,949 in taxes (including self-employment tax) in 1973, based on average 1972 income of $33,542, or 8.8 percent paid in taxes. Colo. Exhs. 1154, 1155; RT Vol. 198 at 104-07.

Of more importance, however, is the apparent failure of Professor Wichelns to take into account the fact that many farmers paid little or no taxes. At the extreme, in 1981 average net farm income in southwest Kansas showed a loss of $13,339. Colo. Exh. 1157 at 20; RT Vol. 199 at 69. This was due to a severe freeze in May of that year. RT Vol. 199 at 69. The Kansas Farm Management Association report for that year called it "The Year Many Would Just as Soon Forget." Colo. Exh. 1156 at 6. Moreover, in 1982, net farm income in the area averaged only $15,701. Colo. Exh. 1157 at 20. While Finney County fared substantially better ($42,431), Hamilton County was just above the average ($18,800) and Kearny was slightly below ($14,487). *Id.* Nationwide, the 1980s were "bleak" years for farmers. Kan. Exh. 919 at 1. Even in the prosperous 1970s, farm income tax returns reporting a loss were about equal to those showing a profit, and in the

1980s loss returns outnumbered those with a profit almost two to one. *Id.*, Table 1; RT Vol. 203 at 33-34. Professor Whittlesey acknowledged that in all years the top income producers would be paying taxes, "but there are many who are not." RT Vol. 203 at 32. In setting a marginal tax rate, "there are losses which have to be averaged in." *Id.*, Kan. Exh. 1002 at 7.

On rebuttal, Professor Whittlesey also analyzed the Kansas Farm Management Association data on which Professor Wichelns relied for his marginal tax rates. Professor Whittlesey had not used those data directly in forming his initial opinion because they contained no analyses of tax records similar to those in the Minnesota farms study, and did not show "even actual taxes paid based on adjusted gross income." RT Vol. 183 at 83. He concluded that Colorado had used the "net farm income" data in the annual Kansas Farm Management Association reports to mean the same as taxable income – which it is not. RT Vol. 203 at 45-46; Kan. Exh. 1002 at 6. The tax forms allow a further adjustment of "net farm income" for credits from previous losses, tax averaging, capital gains, and similar reductions. RT Vol. 203 at 46-47. Studies in the literature indicated that these adjustments could achieve tax savings ranging from 39 percent to 75 percent. Kan. Exh. 908; RT Vol. 203 at 35-36. Professor Whittlesey used the lower figure of 39 percent to adjust the net farm income data in the Kansas Farm Management Association reports to produce what he termed "taxable farm income." *Id.* at 37. Adjusted in this manner, the Kansas Farm Management Association data supports the taxable income levels and marginal tax rates used by

Professor Whittlesey. Kan. Exhs. 1076, 1077; RT Vol. 203 at 36-40; 61-64.

1. *Conclusion.*

I find that the taxable income levels and marginal tax rates used by Kansas are reasonable, and should be employed in calculating the offset against Kansas' damages for federal income taxes.

B. Kansas State Income Taxes.

The Kansas evidence on state income taxes mirrors the testimony on federal rates, except that these calculations became an element of Kansas' damages, rather than an offset thereto. Marginal statutory state rates were used, adjusted for 15 percent, consistent with the procedure for federal taxes. Kan. Exh. 892, Section A at 26; Kan. Exh. 1092, Table A11.

1. *Conclusion.*

I find that the results of the Kansas analysis are supported by the evidence and constitute an appropriate element of damages suffered by Kansas.

SECTION X

SOCIAL SECURITY TAXES

The Kansas damage claim also implicates social security taxes. The role of these taxes in the Kansas analysis is quite different, however, from the Kansas treatment of income taxes. While federal income taxes are deducted from net farm income that would have been realized without depletions, and hence reduce Kansas' damages, the Kansas testimony on social security taxes acts to increase its damage claim.

At the heart of the Kansas analysis of social security taxes is the notion that this program results in a net benefit to participating individuals, and their payments into the program should not be considered like other taxes. Professor Whittlesey concluded that the net present value of future social security benefits would be greater than the social security taxes that would have been paid if there had been no additional pumping to replace depletions. RT 183 at 132. In essence, he established a negative social security net marginal tax rate which was then deducted from and reduced the federal marginal income tax rate. *Id.* at 132-33. The impact of this social security offset against federal income taxes is to increase the Kansas damage claim. RT 180 at 131. Professor Whittlesey concluded that increased pumping expenses reduced net farm income, which in turn reduced contributions into the social security program. As a result, farmers lost social security benefits that they would have been able to achieve absent the depletions. RT Vol. 181 at 20-21. These lost future social security benefits, he said, must be treated the same as other forms of lost farm income. Kan.

Exh. 892, Section A at 25. Professor Whittlesey prepared Kan. Exhs. 1076 and 1077 to show that in all years there were some farmers "who would have benefited from additional income that would contribute to social security taxes." RT Vol. 203 at 84.

There is no question about the fact that the professional journals relied upon by Professor Whittlesey support the view that for many workers, over many periods of time, the benefits of the social security program outweighed the taxes they paid. Kan. Exh. 893 at 254, 259. Moreover, there is a "progressive benefit formula" which relates benefits to the earnings on which the tax is paid. *Id.* at 256. One writer concludes that there is "an unambiguous relation between an additional dollar of payroll tax paid and the incremental amount of future benefits." Kan. Exh. 901 at 3; see also Kan. Exhs. 897, 902. However, even the body of literature relied upon by Professor Whittlesey recognizes that the benefit-tax ratio has changed over time[25] and that individual benefits vary greatly with age, sex and marital status. Kan. Exhs. 893, 901; see also RT Vol. 183 at 126.

Professor Whittlesey recognized these variables, but as an economist, and in order to be "consistent," he believed that he had to consider social security taxes and account for net benefits. RT Vol. 180 at 113, 131-34. The results of his calculations are shown in Kan. Exh. 892, Table A11, as revised in Kan. Exh. 1092, Table A11. This table establishes net social security benefits for every year

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[25] Amendments to the Social Security Act in 1977 and 1983 both increased the tax rate and reduced benefits. Kan. Exh. 893 at 259-60, 263; Kan. Exh. 902 at 20.

from 1955 when the program began through 1996. Net benefits were highest in 1965 at 10.08 percent and declined gradually to 1.07 percent in 1996. These percentages were offset against marginal federal income tax rates. As a result, for example, the marginal income tax rate dropped from 16.89 percent to 8.81 percent in 1955. There were reductions in each of the following years, but they gradually become less. In 1996 the marginal income tax rate was reduced only from 22.25 percent to 21.18 percent. The result of these annual reductions was to increase the damages to Kansas over what they would have been if social security taxes had been ignored. RT Vol. 180 at 131.

Professor Whittlesey's approach was based upon certain acknowledged assumptions. Since the program was voluntary between 1955 and 1965, he assumed that 50 percent of those eligible in 1955 would elect to participate and would pay taxes into the program. He then increased participation and the taxes paid by 10 percent each year until 1965 when such taxes were mandatory. RT Vol. 180 at 103-04, 133. He acknowledged that the 50 percent assumption was a "judgment call," but he believed that people would have wanted to participate because of the very significant benefits that were available, particularly in the early years of the program. RT Vol. 180 at 108; RT Vol. 205 at 41-42.

The second major assumption was that net benefits were calculated for a married man, at age 50, drawing social security benefits at age 65 and earning less than the maximum taxable earnings subject to social security taxes. RT Vol. 180 at 145; RT Vol. 183 at 126. These assumptions were maintained throughout the study

period of 1955-96. Kan. Exh. 892, Section A at 24. No specific data were offered in support of the 50-year age, but Professor Whittlesey said that he had reviewed census data and that the average age of farmers would be very close to 50. RT Vol. 183 at 128. That assumption, however, is critical. One of the journals relied upon by Professor Whittlesey states that for workers aged 65 in 1982, "benefits earned outweighed taxes," but for all workers born after WWII the system would "operate as a tax throughout life." Kan. Exh. 893 at 259, 263.

Also implicit in the Kansas analysis are assumptions on the statutory payroll tax for an individual and his marginal personal income tax bracket. RT Vol. 181 at 7. Above certain and changing net income levels, no social security tax is due. To the extent that farmers earned in excess of the maximum taxable income, a reduction in net income would have had no impact on the amount of social security taxes paid. RT Vol. 195 at 90. Professor Whittlesey assumed that farmers had not already paid a maximum tax. In his judgment, "very few farmers, if any, would have been over the maximum throughout this period." RT Vol. 183 at 111. Kansas introduced Exhibits 1076 and 1077 in support of Professor Whittlesey's testimony. However, these exhibits also show that the top 25 percent of taxable farm income was consistently over the maximum social security limit from 1964 through 1981, and sometimes thereafter. Moreover, the data shown in Exhibits 1076 and 1077 were taken from Southwest Kansas Farm Management Association reports, which cover an area much larger than the ditch service area, and are not necessarily representative thereof. RT Vol. 205 at 86-87, 90-91, 95. Indeed, for 1973 as an example, average

net farm income in Finney County (which has the highest amount of irrigated acreage) was $89,852 compared to $72,000 for the larger southwest area. Colorado evidence also shows that stream depletions causing a reduction in net income in many years would not have had any impact on social security taxes paid. Colo. Exhs. 1150 A, B & C. These exhibits show that some farmers had net losses, and thus would have made no social security payments.

Professor Whittlesey relied upon a 1983 journal article authored by Roger H. Gordon for the actual computation of net social security benefits. Kan. Exh. 902. The Gordon article calculated a net social security tax rate at four ages, that is, 45, 55, 62 and 65, for individuals born in 1910, 1920 and 1940. Kan. Exh. 902 at 18-19. It was necessary then for Professor Whittlesey to make a series of extremely complex adjustments in order to adapt the data on net social security benefits to the ditch service area for the time period involved in this case, and for the assumptions which he made. Even Professor Whittlesey acknowledged that "the method that we have to follow to get there looks obtuse or somewhat cloudy." RT Vol. 181 at 19. An example of the steps required and the mathematics of the adjustments are shown in Kan. Exh. 918. These adjustments lend but one more level of uncertainty to the Kansas analysis. Colorado further points out that self-employment social security taxes include payments for disability and health insurance, and benefits for these purposes do not vary with the amount of money paid into the program over time. RT Vol. 195 at 95. Payments for disability and health insurance are shown on Colo. Exh. 1149.

The Colorado expert, Professor Wichelns, seemed to concur that net social security benefits, if shown, should be deducted from federal income tax. RT Vol. 195 at 91-92. However, he believed that the facts do not show the necessary linkage between reductions in net income and reductions in benefits from social security. *Id.* at 93. In his view, there is "very little information regarding the actual role of social security taxes or benefits among farmers in the ditch service areas." RT Vol. 210 at 20. He acknowledged that in the early years, certain individuals earned net income benefits from the social security taxes paid. But he also pointed out that the program changed over time, and in later years, "it's not clear that social security would provide benefits over the long haul." RT Vol. 195 at 90. For some, social security taxes "are indeed a tax and not a net benefit." *Id.* at 93. In his view, it was "more sensible" not to consider either social security taxes or net benefits therefrom in the estimation of Kansas' damages. *Id.* at 93; RT Vol. 210 at 19.

Professor Whittlesey approached the issue of social security taxes as an economist using what he believed to be the most professional methods. However, foregone social security benefits become a distinct element of Kansas' damages, and as such, must meet legal requirements. I find that these benefits are too speculative, and involve too many assumptions that may not be generally applicable, to meet the legal standards for damages. Restatement (Second) of Contracts, § 352 (1981); McCormick on Damages, § 26 at 100 (1935); *Knapp Shoes, Inc. v. Sylvania Shoe Mfg. Corp.*, 72 F.3d 190, 204 (1st Cir. 1995); *San Carlos Irrigation and Drainage Dist. v. United States*, 111 F.3d 1557, 1563 (Fed.Cir. 1997).

A. Conclusion.

Social security benefits should not be used to offset and reduce the marginal income tax rates used by Kansas.

SECTION XI

THE TIME VALUE OF MONEY – PREJUDGMENT INTEREST

A line in the case, *Matter of Oil Spill By the Amoco Cadiz*, 954 F.2d 1279 (7th Cir. 1992), immediately caught my eye: "Because the accident occurred so long ago, the largest issue in the case is prejudgment interest." 954 F.2d at 1330. That is the key issue here, although to the Kansas economists, the subject is all about the ancient principle of the "time value of money," on which there should be no issue at all. On the other hand, to the Colorado experts, the issue is a matter of "prejudgment interest," to be governed by legal constraints, not by economic principles. But whatever the terminology, the concepts, or the applicable rules, the questions here involved take us some distance beyond the cases that have previously considered the issues.

The total Kansas damage claim for shortages over the period from 1950 to 1994, brought to a 1998 value, is $62,369,173. Kan. Exh. 1092, Table D7. This total is broken down as follows: $9,218,305 for direct and indirect losses, in actual dollars when the damages occurred (except for future losses). These damages are comprised of the additional costs of pumping within the ditch service areas to replace surface water depletions; increased regional pumping costs, both historic and for the future period 1998-2048 (future costs were discounted back to a 1998 value); crop production losses on surface water only lands; and secondary impacts to the Kansas economy. The remaining portion of the total claim, namely, $53,150,867

out of $62,369,173, represents what the Kansas economists refer to as the time value of money. This economic concept includes both inflation and compensation for the loss of use of funds, and is reflected in a single "interest rate." Here, the total claim of $62,369,173 is composed of $21,386,697, which is the $9,218,305 loss figure adjusted for inflation, and $40,982,476 which represents lost investment opportunities. Thus, prejudgment interest, as the term has been used by Kansas in this case, includes an adjustment of the historic losses for inflation, as well as a rate of interest which might have been earned on funds wrongfully lost.[26] Applying well accepted economic principles governing the time value of money, the Kansas economic experts brought both past and future damages to a present value, i.e., 1998.

Colorado's experts put Kansas' damages at $4,742,071 in "nominal dollars," that is, the actual dollars at the time of the loss, except for future pumping costs which were discounted to a present value. Colo. Closing Br. at 13-14, Table 3. Adjusted for inflation only, using the CPI, the total becomes $9,047,075. Colorado letter dated 3/2/2000. Colorado offered no evidence on prejudgment interest, except as inflation is included as part of a prejudgment interest rate. RT Vol. 199 at 21. Colorado states "that a fair and equitable remedy is simply to adjust the damages awarded for inflation." Colo. Closing Br. at 110.

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[26] It is easy to become confused on this point because in lay parlance "inflation" and "interest" are separate concepts. Moreover, while Colorado has generally opposed "prejudgment interest," it has acknowledged the need to adjust Kansas losses for inflation.

Recent cases hold, however, that adjusting for inflation is not a full substitute for prejudgment interest. A consumer price index adjustment "simply ensures that inflation does not erode the value of money"; it does not "compensate for the lost use of the money in the intervening time." *United States v. City of Warren, Mich.*, 138 F.3d 1083, 1096 (6th Cir. 1998). See also *Chandler v. Bombardier Capital, Inc.*, 44 F.3d 80, 84 (2d Cir. 1994); *Clinchfield Coal Co. v. Federal Mine Safety and Health Review Commission*, 895 F.2d 773, 780 (D.C.Cir. 1990).

A. Kansas' Expert Economic Opinions.

In addition to Professor Whittlesey, three economic experts[27] testified for Kansas on the subject of prejudgment interest, including the specific interest rates used to

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[27] These expert witnesses were Professor Peter Barry, whose qualifications are described in Section VI, Professor William F. Sharpe, and Dr. Gary L. Benjamin.

Professor Sharpe is a long-time professor, now emeritus, in the Graduate School of Business at Stanford University, and a preeminent advisor to the United States investment industry. He has served as a consultant for pension funds totaling more than 200 billion dollars (for the California Public Employees Retirement System, AT&T, and Hewlett Packard), and is an advisor to Wells Fargo, Merrill Lynch, UPS, and the Union Bank of Switzerland. RT Vol. 190 at 32-33. He is the author of six books, and innumerable articles in professional journals. He is past president of the American Finance Association. In 1990, he received the Nobel Prize in Economic Sciences. Kan. Exh. 981.

Dr. Benjamin is a retired official of the Federal Reserve Bank of Chicago who worked with agriculture in that system for a period of some 28 years. He was responsible for the Bank's popular "AgLetter." Kan. Exh. 980.

compound past damages (including an adjustment for inflation) and to discount those occurring in the future. While economists speak in terms of the time value of money, it was recognized that compounding historic losses and costs to a current value is the same in a legal sense as adding prejudgment interest. RT Vol. 183 at 74. As a general economic principle, Colorado stated that there was no dispute about the time value of money. RT Vol. 178 at 30; RT Vol. 199 at 18-21.

Professor Sharpe, who was awarded the Nobel Prize in Economics in 1990, pointed out that the time value of money is an ancient principle, going back to loans of seeds and animals. RT Vol. 190 at 52, 61. Today, it is a "fundamental principle of economics," affecting every aspect of our lives. It holds that:

> " . . . it is essential to recognize the effect of time, either past or future, when determining the value of any asset or liability. Thus, in economic transactions, an amount owed in the past cannot be paid off today by paying the same nominal value that would have been owed had it been paid in the past. Rather, the past nominal amount must be increased to a higher present nominal amount in order to account for the earning power of the original value during the time that has passed. Likewise, an amount owing in the future must be discounted to a lower present value in order to account for the future earning power of the value in question over the future period." Kan. Exh. 982 at 1.

Professor Sharpe testified that by compounding past values to the present, and discounting future values to the present, financial values are put on a common

ground. *Id.* The interest rate used to bring a past obligation to present value includes three components. He testified that the first is compensation for price level changes, or inflation. The interest rate must be at least as high as the rate of inflation, or one would have less purchasing power than was present at the beginning. RT Vol. 190 at 45. The second component represents the preference to have purchasing power now, rather than later. *Id.* at 46. Sometimes this element is described as "opportunity cost," representing the opportunity to invest and earn from such funds. RT Vol. 189 at 29-30. The last element, if risk is involved, would be an additional amount of interest to compensate for that risk. RT Vol. 190 at 46. In Professor Sharpe's opinion, to be consistent with fundamental economic principles and financial practices, damages arising from violation of the compact must be converted to present values using appropriate rates of interest. Kan. Exh. 982 at 3.

The specific rates of interest used to compound historic damages were carefully developed by Professor Whittlesey and Professor Barry. RT Vol. 189 at 39-54. These are found in Kan. Exh. 1092, Table A12 at 17, and reflect varying rates depending upon inflation and market conditions in the years since 1850. Colorado's expert, Professor Wichelns, did not present any opinion as to what the appropriate interest rates should be if one were to account fully for the time value of money, that is, for both inflation and lost investment opportunities. RT Vol. 199 at 21.

Kansas' experts concluded that Colorado would enjoy a windfall if the principle of time value of money were not applied to past losses. Kan. Exh. 979 at 2; Kan.

Exh. 982 at 3; RT Vol. 189 at 105-06. Conversely, applying prejudgment interest is not "punitive"; it is merely "taking that which is gained by one party and lost by the other and restoring things to the point of equality." RT Vol. 203 at 96-97.

B. Colorado's Position on Prejudgment Interest.

To begin with, in earlier briefs on certain damage issues, Colorado took the position that Kansas' damages were unliquidated, and that prejudgment interest could not be awarded as a matter of law on an unliquidated claim. That argument was dealt with in my Second Report filed in September 1997. The Second Report recommended: "That the unliquidated nature of Kansas' claim for damages does not bar the award of prejudgment interest, whether the remedy includes money damages or water repayment." Second Report at 113-114. Colorado filed an Exception to this recommendation. The Court overruled the Exception, but without prejudice to Colorado's right to renew the Exception at the conclusion of these remedial proceedings. 522 U.S. 1073 (1998). The section of my Second Report dealing with this issue is now included as Exhibit 4 in the Appendix. I still remain of the same opinion, and make the same recommendation, namely that prejudgment interest is not barred as a matter of law.

Apart from Colorado's Exception, and speaking strictly as an economist, Professor Wichelns testified that, "we need to adjust past values to account for inflation." RT Vol. 199 at 19. However, he saw the issue of compounding interest for past losses or past damages as a

"policy issue," and offered no opinion. *Id.* He recognized that adjusting for changes in the purchasing power of the dollar over time is not the same as prejudgment interest. RT Vol. 199 at 21. He also acknowledged that one aspect of the time value of money principle requires discounting future accounts owed if they are going to be settled in the present. *Id.* at 24. This, he agreed, as an economic matter, is essentially the same principle as compounding past amounts owed. *Id.* It should be noted that Colorado did discount the future costs of additional pumping caused by depletions, although it contests compounding the additional historic costs.

Colorado argues that prejudgment interest, apart from an adjustment for inflation, should be denied for a number of reasons. First, Colorado points out that neither state was aware for many years that postcompact well pumping in Colorado was depleting usable Stateline flows in violation of the compact.[28] Second, there is no statute of limitations applicable to a compact breach which could serve to limit the amounts due, or to assure the use of more recent and better data from which to determine damages. Third, Colorado states that farmers in Kansas during this period were themselves drilling wells, and those who did not, could have, at least until 1978. Fourth, to the extent that damages are based upon increased costs of pumping groundwater or crop production losses, the damages will not be paid to those water

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[28] Colorado states that this was not known until at least 1984. I believe that the impact of postcompact well pumping in Colorado was known, or should have been known, before that time.

users, but to the State of Kansas. In the absence of a knowing or intentional breach of the compact, Colorado argues that the State of Kansas should not be allowed to recover all of the losses, and prejudgment interest, at rates incurred by the water users. Finally, if prejudgment interest is to be awarded, the interest rate to be used "requires careful thought." Colo. Closing Br. at 110. Kansas experts used interest rates which reflected inflation and the opportunity costs to farmers to compound the losses attributed to farmers. *Id.*; Kan. Exh. 892, Section A at 28-29, Table 12. Colorado argues that the rate of interest applicable to the State of Kansas, which is lower, should have been used instead.

C. Legal Principles Governing an Award of Prejudgment Interest.

The award of prejudgment interest is not unique. As I concluded in my Second Report, a majority of jurisdictions now reject the traditional approach which allowed prejudgment interest only under statute or on a liquidated claim. Second Report at 106-07. A recent case states that prejudgment interest is now the "norm in federal litigation"; it is an "ordinary part of any award under federal law." *Matter of Oil Spill by the Amoco Cadiz*, 954 F.2d 1279, 1331-32 (7th Cir. 1992), citing *West Virginia v. United States*, 479 U.S. 305, 310, 93 L.Ed.2d 639, 107 S.Ct. 702, 706 (1987); see also *General Motors Corp. v. Devex Corp.*, 461 U.S. 648, 655-56, 76 L.Ed.2d 211, 103 S.Ct. 2058, 2062-63 (1983); *Barbour v. Merrill*, 48 F.3d 1270, 1278-79 (D.C. Cir. 1995); *Lorenzen v. Employees Retirement Plan of Sperry & Hutchinson Co.*, 896 F.2d 228, 236 (7th Cir. 1990); *Gorenstein Enterprises, Inc. v. Quality Care-USA, Inc.*, 874 F.2d 431, 436-37 (7th Cir. 1989).

A recent patent case states:

> " . . . neither pre- nor postjudgment interest awards are unique to patent law. Many other areas of law besides patent law, including contract, tort, insurance, admiralty, employment, securities, and civil rights, also provide for prejudgment interest awards under both statutory and common-law authority." *Transmatic, Inc. v. Gulton Industries, Inc.*, 180 F.3d 1343, 1347 (Fed.Cir. 1999).

In a footnote the Court then provides the following citations: 15 U.S.C. §§ 15(a), 15a (1994) (antitrust); 17 C.F.R. § 201.600 (1994), *reprinted in* 15 U.S.C. foll. § 78u (securities); 29 U.S.C. § 1132(a)(9) (1994) (ERISA); *City of Milwaukee v. Cement Div. Nat'l Gypsum Co.*, 515 U.S. 189, 132 L.Ed.2d 148, 115 S.Ct. 2091 (1995) (admiralty); *United States v. Texas*, 507 U.S. 529, 123 L.Ed.2d 245, 113 S.Ct. 1631 (1993) (contract); *Milwaukee Brewery Workers' Pension Plan v. Jos. Schlitz Brewing Co.*, 513 U.S. 414, 130 L.Ed.2d 932, 115 S.Ct. 981 (1995) (ERISA); *Loeffler v. Frank*, 486 U.S. 549, 100 L.Ed.2d 549, 108 S.Ct. 1965 (1988) (Title VII); *Morales v. Freund*, 163 F.3d 763 (2nd Cir. 1999) (securities); *Gierlinger v. Gleason*, 160 F.3d 858 (2nd Cir. 1998) (§ 1983); *United States v. Township of Brighton*, 153 F.3d 307 (6th Cir. 1998) (CERCLA); *Cimino v. Raymark Indus., Inc.*, 151 F.3d 297 (5th Cir. 1998) (tort); *Fratus v. Republic W. Ins. Co.*, 147 F.3d 25 (1st Cir. 1998) (insurance).

Also there is now ample authority that prejudgment interest is not an added remedy, but simply is part of providing full compensation to the injured party. *West*

Virginia v. United States, 479 U.S. 305, 310 n. 2, 93 L.Ed.2d 639, 107 S.Ct. 702 (1987) ("Prejudgment interest serves to compensate for the loss of use of money due as damages from the time the claim accrues until judgment is entered, thereby achieving full compensation for the injury those damages are intended to redress."); *Transmatic, Inc. v. Gulton Industries, Inc.*, 180 F.3d 1343 (Fed. Cir. 1999), citing *West Virginia v. United States; United States v. City of Warren, Mich.*, 138 F.3d 1083, 1096 (6th Cir. 1998) ("An award of prejudgment interest 'is an element of complete compensation' in a Title VII back pay award," citing cases); *Chandler v. Bombardier Capital, Inc.*, 44 F.3d 80, 83 (2nd Cir. 1994) ("The purpose of a prejudgment interest award in a wrongful termination case is to compensate a plaintiff for the loss of use of money that the plaintiff otherwise would have earned had he not been unjustly discharged," citing cases); *Matter of Oil Spill by the Amoco Cadiz*, 954 F.2d 1279, 1331 (7th Cir. 1992) ("Prejudgment interest is an element of complete compensation," citing *West Virginia v. U.S.* and other cases); *Northern Natural Gas Co. v. Grounds*, 393 F.Supp. 949, 991 (1974) ("The object of this phase of the litigation is to assure that just compensation be paid . . . [and] an award of prejudgment interest is required in order to assure this result.")

Prejudgment interest, as a legal matter, is intended to compensate injured parties both for the time value of the lost money as well as for the effects of inflation. *United States v. City of Warren, Mich.*, 138 F.3d 1083 (6th Cir. 1998). "Money today is not a full substitute for the same sum that should have been paid years ago." *Matter of Oil Spill by the Amoco Cadiz*, 954 F.2d 1279, 1331 (7th Cir. 1992). "Prejudgment interest, like all monetary interest, is

simply compensation for the use or forbearance of money owed." *Transmatic, Inc. v. Gulton Industries, Inc.*, 180 F.3d 1343, 1347 (Fed. Cir. 1999). "Prejudgment interest is not awarded as a penalty; it is merely an element of just compensation." *City of Milwaukee v. Cement Division, National Gypsum, Co.*, 515 U.S. 189, 197, 132 L.Ed.2d 148, 115 S.Ct. 2091 (1995).

However, prejudgment interest lies within the sound discretion of the Court. It is not to be awarded according to any rigid theory of compensation for money withheld, "but is given in response to considerations of fairness." *Jackson County v. United States*, 308 U.S. 343, 352, 84 L.Ed. 313, 60 S.Ct. 285 (1939); *United States v. City of Warren, Mich.*, 138 F.3d 1083 (6th Cir. 1998); *Matter of Oil Spill by the Amoco Cadiz*, 954 F.2d 1279, 1334 (7th Cir. 1992). There is also authority that a *denial* of prejudgment interest may be unfair, and should be justified. *City of Milwaukee v. Cement Division, National Gypsum Co.*, 515 U.S. 189, 132 L.Ed.2d 148, 115 S.Ct. 2091 (1995); *Matter of Oil Spill by the Amoco Cadiz*, 954 F.2d 1279, 1334 (7th Cir. 1992). Prejudgment interest was denied on grounds of fairness in *Jackson County v. United States*, 308 U.S. 343, 84 L.Ed. 313, 60 S.Ct. 285 (1939); *Nedd v. United Mine Workers of America*, 488 F.Supp. 1208 (1980) ("Justice requires the disallowance of interest.")

D. Considerations in this Case Affecting Prejudgment Interest.

Kansas can argue persuasively, and has done so, that the law strongly supports the inclusion of prejudgment interest as part of a damage award. Likewise, there is no

doubt that fundamental economic principles require the same result. Yet there is no case in which prejudgment interest has been awarded that is at all similar to the facts in this dispute. Indeed, even damages as a potential remedy for the violation of an interstate water compact were not recognized until 1987 in *Texas v. New Mexico*, 482 U.S. 124, 96 L.Ed.2d 105, 107 S.Ct. 2279 (1987). When Kansas filed its complaint, it sought only a decree commanding Colorado "to deliver the waters of the Arkansas River in accordance with the provisions of the Arkansas River Compact." Not until the *Texas v. New Mexico* decision was the Kansas complaint amended to include a claim for damages.

Nonetheless, looking to the law generally and apart from interstate water disputes, the cases favor the inclusion of prejudgment interest as a component of damages, unless circumstances justify otherwise. Some cases specifically articulate a presumption in favor of such inclusion. *Barbour v. Merrill*, 48 F.3d 1270, 1279 (D.C. Cir. 1995); *Gorenstein Enterprises, Inc. v. Quality Care-USA, Inc.*, 874 F.2d 431, 436 (7th Cir. 1989); *Waterside Ocean Navigation Co. v. International Navigation Ltd.*, 737 F.2d 150, 154 (2nd Cir. 1984). Prior to *City of Milwaukee v. Cement Division, National Gypsum Co.*, 515 U.S. 189, 132 L.Ed.2d 148, 115 S.Ct. 2091 (1995), the courts had developed several criteria for the exercise of their discretion if such interest were to be denied: whether laches was present; whether there was a genuine dispute over a good faith claim in a mutual fault situation; whether the plaintiff had been less than diligent in prosecuting the action, or guilty of improper delaying tactics; whether the defendant had been unjustly enriched; whether prejudgment interest

would be compensatory rather than punitive. *Reeled Tubing, Inc. v. M/V Chad G*, 794 F.2d 1026, 1028 (5th Cir. 1986); *Segal v. Gilbert Color Systems, Inc.*, 746 F.2d 78, 82-83 (1st Cir. 1984); *Noritake Co., Inc. v. M/V Hellenic Champion*, 627 F.2d 724, 728-29 n. 3 (5th Cir. 1980); *Nedd v. United Mine Workers of America*, 488 F.Supp. 1208, 1219-20 (M.D. Pa. 1980).

Milwaukee, however, dismissed the argument of a good faith dispute as having "little weight," and stated that the Court was "unmoved" by the magnitude of the plaintiff's fault in a comparative negligence situation. 515 U.S. at 197, 199. Apart from the issue of delay, the courts actually have "done little to sketch the limits of acceptable discretion" in denying prejudgment interest. *Matter of Oil Spill by the Amoco Cadiz*, 954 F.2d 1279, 1334 (7th Cir. 1992). Yet, one fundamental standard still appears to remain – that prejudgment interest is given "in response to considerations of fairness." *Jackson County v. United States*, 308 U.S. 343, 352, 84 L.Ed. 313, 60 S.Ct. 285 (1939). Likewise, the remedy in this case, taken as a whole, must be a "fair and equitable solution." *Texas v. New Mexico*, 482 U.S. 124, 134, 96 L.Ed.2d 105, 107 S.Ct. 2279 (1987).

The obvious difference between the many reported cases on prejudgment interest, and the facts at hand, is the great length of time between the first depletions of usable Stateline flow and a judgment. At least 50 years will be involved. Two cases have been found with a lag of 20 to 30 years between injury on some claims and judgment, but no longer period of time. *Wilkerson v. Ingalls Shipbuilding, Inc.*, 125 F.3d 904 (5th Cir. 1997); *Nedd v. United Mine Workers of America*, 488 F.Supp. 1208 (1980). And in each of these cases, although for reasons other

than the delay, interest was actually denied. Normally, either a statute of limitations or the application of laches would preclude a large buildup of prejudgment interest. That is not to say, however, that such interest cannot be large and exceed the basic claim. In the *Matter of Oil Spill by the Amoco Cadiz*, the Court upheld prejudgment interest of more than $120 million, accrued over 13 years, on a damage award of $61 million. 954 F.2d at 1330, 1335. And in *City of Milwaukee*, damages were $1.67 million, and prejudgment interest amounted to $5.3 million. 515 U.S. at 192. However, because prejudgment interest is an element of "full compensation," an award of such interest "no matter how large, cannot be called 'punitive.' " *Matter of Milwaukee Cheese Wisconsin, Inc.*, 112 F.3d 845, 849 (7th Cir. 1997).

Nonetheless, without some limitation, compounding even small damages over 50 years produces startling results. For example, the Kansas evidence shows additional pumping costs within the ditch service areas in 1950 amounting to only $103. Compounded to 1998, these damages become $4166. Kan. Exh. 1092, Table A18. Likewise, crop losses in 1950 amounted to only $2060 according to Kansas' evidence, but compensation sought for these losses is $83,594. Kan. Exh. 1092, Table C10. The H-I model has computed depletions in usable flow for 1950, and each year after, and Kansas turns those shortages into damages. Yet I am confident that in 1950, the first year after the compact was signed, and in the early years thereafter, no one had any thought that the compact was being violated. It was lawful in Colorado to drill wells without state permission, and Colorado farmers saw the

same kind of well development going on along the Arkansas River in Kansas.

In many of the prejudgment interest cases, the defendant has the money in hand, either wrongfully withheld or wrongfully collected from the plaintiff, and thus has the use of the money until final judgment. Prejudgment interest prevents such a defendant from profiting from the wrong. *Gore, Inc. v. Glickman*, 137 F.3d 863 (5th Cir. 1998); *Matter of Oil Spill by the Amoco Cadiz*, 954 F.2d 1279 (7th Cir. 1992). The situation here is different. The benefits of the usable flows withheld went primarily to Colorado farmers, not to the State of Colorado. Likewise, except for taxes lost to the State of Kansas and the secondary impacts to the Kansas economy, both of which are relatively small, the additional costs and crop losses were suffered by Kansas farmers, yet damages go to the state. Prejudgment interest here neither takes from those who benefitted, nor goes to those who were injured. Kansas, of course, does not see this as a meaningful distinction. For 50 years, it argues, Colorado has had the advantage of water belonging to Kansas, and should not now be allowed to gain from compact violations. That there have been gains, both to Colorado farmers and to the State of Colorado, is not in doubt. Surely that is why Colorado opposed the legal position taken by Kansas, namely, that damages be determined on the basis of gains in Colorado rather than injury to Kansas. I ruled against Kansas on this issue (see Exhibit 1 in the Appendix) but we should not be oblivious to Colorado's use of the water over this long period of years.

An interstate water compact, besides being federal law, is a contract. *Texas v. New Mexico*, 462 U.S. 554, 564,

77 L.Ed.2d 1, 103 S.Ct. 2558 (1983). Though a compact deals in water rather than money, many of the same policies calling for prejudgment interest in general contract situations also apply to interstate water disputes. The upstream state has a natural geographic advantage. It has first access to the water. It can take what it wants, leaving the downstream state to complain if the upstream use exceeds its compact share. An enforcement action by the downstream state is not only difficult and expensive, it almost always requires years to complete. Generally, a preliminary injunction is not available, and the upstream state continues to have use of water during the long trial. In many situations, the problem begins with the compact itself, which may be quite vague. The Arkansas River Compact, for example, does not allocate to Kansas either a defined quantity of water or a specific share of river flow. Rather, it calls for an "equitable" division, and only places restrictions on new Colorado water development that will cause material depletions of usable flows into Kansas. The problems of data collection are also enormous. In this case, new wells were the principal cause of the Stateline depletions. But, initially, there were no records of the number of wells, where they were located, or how much water they pumped. All of these data, and much more, had to be developed before specific determinations of well impacts could be made.

I am convinced, in general, that prejudgment interest adjusting for inflation and for the loss of use of funds owed should be included in any damage award for violation of an interstate water compact. I have difficulty, however, in recommending the full amount sought by Kansas in this case. Given the long delay here, and the

dramatic impact of compounding over so many years, fairness would seem to deny at least a portion of prejudgment interest during the early years when neither state understood that depletions were occurring. Colorado contends that it was not aware of a compact violation until at least 1984. Colo. Closing Br. at 107. I disagree. I find that by 1968 Colorado knew, or should have known, that postcompact wells were causing material depletions of usable Stateline flows. It is essentially correct that Kansas did not register a formal complaint until 1985, but that is not to say that Colorado was unaware of the impact of its postcompact pumping until that time.

Prior to 1965 Colorado had no system for the regulation of groundwater water. While surface diversions had required state permits since the 1800s, and were closely regulated on a "first in time, first in right" basis, wells could be drilled without state permission and even without the state's knowledge. Nor were any reports required of the amounts pumped. Colorado's evidence showed that some 1233 new large irrigation wells were drilled along the Arkansas River between 1949 and 1965. Colo. Exh. 165*, Table A1. Colorado's database constructed for the trial estimated that pumping in 1950 amounted to 41,458 acre-feet, and had increased to 203,925 acre-feet in 1964. *Id.*

The pressure to regulate groundwater pumping came first, not from Kansas, but from holders of downstream surface diversion rights in Colorado, and resulted in 1965 state legislation. Under this new legislation, the State Engineer was ordered to administer wells along the Arkansas River in accordance with the doctrine of prior appropriation, that is, to subordinate new wells to prior

surface diversion rights. Colo. Exh. 378. The State Engineer's first effort to enforce the new law, however, was struck down by the Colorado Supreme Court. *Fellhauer v. People*, 167 Colo. 320, 447 P.2d 986 (1968). Further legislation then resulted in a comprehensive study of both surface diversions and groundwater pumping along the Arkansas River, known as the 1968 Wheeler Report. Jt. Exh. 92. This Report, which was published at the direction of the state legislature, found that well use in recent years had "materially decreased the surface flows available to direct flow and storage rights." *Id.* at vi. The Wheeler Report and more state legislation led finally to new rules limiting pumping to three days a week, without mitigation measures to protect prior rights. Jt. Exh. 93. While these Colorado efforts were aimed at protecting downstream surface diversions in Colorado from the impacts of new and excessive pumping, Colorado had to know that the impacts on the other side of the Stateline in Kansas were no different.

During the liability phase of the trial, Colorado sought to bar Kansas from any relief, claiming that the facts concerning well development in Colorado were common knowledge by the mid-1960s, and that Kansas was guilty of laches. That contention has a double edge. Colorado is in no position now to claim that it was unaware of the problems caused by unregulated pumping until at least 1984.

With regard to the issue of fairness, Kansas itself recently argued that Kansas gas producers should not be responsible for prejudgment interest on refunds of payments that were made in reliance upon a decision of the Federal Energy Regulatory Commission that was lawful

at the time. *Anadarko Petroleum Corp. v. FERC*, 196 F.3d 1264 (D.C.Cir. 1999). Federal law established maximum prices on certain natural gas sales, but allowed an excess charge to recover state severance taxes. FERC ruled that a Kansas ad valorem tax was such a severance tax, and accordingly allowed higher prices. However, this ruling was challenged in 1983, and in 1988 the Court held that the FERC rule "fell short of reasoned decision-making." *Colorado Interstate Gas Co. v. FERC*, 850 F.2d at 769, 770 (D.C. Cir. 1988). The case was remanded to allow the Commission to show what would be required for a tax to be similar to a production or severance tax. Five years passed before FERC acted on the remand, and then the Commission simply reversed its earlier decision, and ordered repayment of all excess charges after 1988, together with interest. Interest charges amounted to 160 percent of the principal.

Kansas sought to have all producers relieved of the interest charges because: "the litigation has gone on forever;" the Commission was responsible for much of the delay; and the producers had relied upon the Commission's settled view that the Kansas ad valorem tax was a severance tax. *Anadarko Petroleum Corp. v. FERC*, 196 F.3d at 1268. The Court of Appeal was not persuaded, stating that neither the Commission's legal errors nor its "snail-like pace" were grounds for changing the producers' interest obligations. *Id.* It was the customers, ruled the Court, who had paid more than they should, and who were entitled to be made whole. Quoting *Matter of Milwaukee Cheese Wisconsin, Inc.*, the Court said: "Compensation deferred is compensation reduced by the time value of money." *Id.* at 1267.

The general lack of knowledge in the early years about pumping in Colorado and its impacts along the Arkansas River served to protect Kansas during the liability phase of the case against a claim of laches. The same degree of fairness, I believe, should now relieve Colorado of the obligation to pay full interest rates on damages from depletions during 1950-68 period, which now only with hindsight and the benefit of sophisticated computer modeling can be found to have occurred.

Kansas argues that Colorado's awareness, or lack of awareness, of compact violations during the early years should have no bearing here. They contend that Colorado's knowledge would be a consideration only if prejudgment interest were part of a punitive damage award rather than an element of compensatory damages. As a policy issue, they also say that compact compliance is hardly encouraged if an upstream state is better off the less it knows. But Kansas fails to acknowledge that it too was involved. Neither state in the early years saw any wrongdoing, or thought that Kansas was not receiving its compact share of usable flows of the Arkansas River. Under these circumstances, it does not now seem fair to impose compound interest rates for that period of time.

There is, however, another consideration in the award of prejudgment interest during these early years. Three elements can be involved in any such award: an interest rate to reflect the loss of use of money owed; a rate to reflect inflation; and a risk factor, although that is not applicable here. Denial of "prejudgment interest" during the 1950-68 period would ordinarily mean that only "nominal" damages would be recovered, that is, only the actual dollar values at the time of the loss. But

here, Colorado itself states that a "fair and equitable remedy" would adjust all damages for inflation. Colo. Closing Br. at 110. Also, Colorado's chief expert Professor Wichelns, speaking as an economist, testified to the need to adjust past values to account for inflation. RT Vol. 199 at 19. Given the Colorado position, I thus recommend that actual damages for the period 1950-68 should be adjusted for inflation, but should not bear compound interest reflecting the loss of use of those monies.

E. Conclusion.

Kansas' damages, as determined in earlier Sections of this Report, should include prejudgment interest at rates proposed by Kansas, but only from 1969 to the date of judgment. These rates properly include inflation and the loss of use of money due as damages. Damages incurred during the 1950-68 period should be adjusted for inflation only using rates proposed by Kansas.

SECTION XII

REPAYMENT IN WATER

At the conclusion of the evidence on money damages, Colorado presented a proposal for repayment in water. This was included in an expert report (Colo. Exh. 1205) testified to by James Lochhead[29] and Dr. Leo M. Eisel.[30] On rebuttal, the Colorado State Engineer, Hal D. Simpson, also testified on the proposed remedy. While I have ruled that *Texas v. New Mexico* allows a suitable remedy in either money damages or in water, Colorado has long taken the position that repayment in water "would likely be a more equitable remedy in this case." Second Report at 72-73. Colorado's opening statement on this phase of the trial, however, foreshadowed a softening of this position. Counsel stated that the water repayment proposal originated in part over concerns that lowered water tables in the Ogallala aquifer would result in substantial damages that would be difficult to offset, and

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[29] Mr. Lochhead is an attorney in private practice in Denver, Colorado, and participated in the preparation of Colo. Exh. 1205. Until recently, he served as the Executive Director of the Colorado Department of Natural Resources. He also served on the Colorado Water Conservation Board for fifteen years, and was Colorado's commissioner to the Upper Colorado River Commission for eleven years. His qualifications are shown in Colo. Exh. 1204*.

[30] Dr. Eisel is a consulting engineer with the well known firm of Brown & Caldwell, and is the former Director of the U.S. Water Resources Council. His qualifications appear in Colo. Exh. 1015*. Dr. Eisel was responsible for the engineering aspects of the proposal, particularly the investigation into the availability of water for repayment purposes, and the storage required.

that repayment in water, over time, would restore these water levels. RT Vol. 211 at 44. As it turned out, he stated, the Kansas claim for these damages "is in a relatively reasonable range." *Id.* Moreover, counsel stressed that Colorado did not want to insist upon a form of remedy "that will only engender years of additional controversy."[31] *Id.* at 50.

Mr. Simpson had the last word on Colorado's water remedy proposal, testifying after several Kansas experts had raised a number of concerns and objections. He confirmed his counsel's statement about the original reason for the proposal:

> "I would conclude by saying and emphasizing again that the reason we suggested repayment in water was our concern about the lowered water levels in the Ogallala aquifer and that the future pumping costs would be very significant. As we now know, those are not the situation." RT Vol. 214 at 69.

Then Mr. Simpson added:

> "And because of Mr. Pope's [Kansas Chief Engineer, Division of Water Resources] opinions, it would appear to me that repayment in water would be a difficult situation to undertake. It appears that they would resist many ways what we would propose to do. It would result in some expensive and time-consuming disputes.

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[31] In his opening remarks, counsel for Kansas said that Kansas did in fact believe that the proposal would "engender years of controversy." RT Vol. 211 at 50-51.

> I think Colorado's position is we would like to end this litigation and not have it continue under a different format for another 15 years."

On cross-examination, Mr. Simpson seemed to distance Colorado even further from its water repayment proposal:

> "Q. Do I understand your testimony to be that, given the size of the Kansas claim for money damages as it now stands, that it may be appropriate to prefer that form of remedy over a water repayment remedy?
>
> A. I think, as I summarized, the potential for ongoing disputes, carrying the litigation forward under another format or under the review of a river master and the fact that the monetary damages from future pumping costs associated with the lowered water levels in the Ogallala aquifer are smaller than we thought, *repayment in water may not be as desirable as Colorado originally had thought and it may not, in fact, be the best way to go.*" RT Vol. 214, pp. 70-71, emphasis added.

Nonetheless, I believe that it is still appropriate to include a review of the Colorado proposal to repay in water.

A. The Colorado Proposal.

Colorado's proposal to repay past depletions of usable Stateline flows in water was developed and presented by Dr. James S. Lochhead and Dr. Leo Eisel. They looked at the feasibility of repaying approximately 430,000 acre-feet, in addition to any amounts of water required for current compliance. RT Vol. 211 at 114; RT

Vol. 212 at 27. Depletions for the period 1950-96 have been determined to be 428,005 acre-feet. Jt. Exh. 183. The proposal was to repay depletions over fifteen years at an average rate of approximately 30,000 acre-feet per year, based on a moving five year average. Colo. Exh. 1205 at 1. Annual deliveries could vary between 24,000 acre-feet and 40,000 acre-feet. *Id.* at 3. It would be necessary to acquire approxin tely 30,000 acre-feet of storage rights in John Martin Reservoir, to allow Colorado to take advantage of carrying over water available in wet years, and to allow Kansas to call for deliveries as needed. Although repayment was to be made over fifteen years, no additional water or "water interest" was to be made. RT Vol. 212 at 61, 79.

On average, 30,000 acre-feet annually was thought to be an amount of water that Kansas farmers could beneficially use. RT Vol. 211 at 118, 121-24. Colorado prepared a table for the years 1950 through 1994 showing that in almost all years the Kansas ditches were short of water, entirely apart from Stateline depletions caused by Colorado. Assuming no Stateline depletions, total ditch shortages still averaged 86,337 acre-feet annually over this period of time. Colo. Exh. 1205, Table 1. 30,000 acre-feet on average was also thought to be an amount of water which Colorado could acquire and pay for. RT Vol. 212 at 47. Colorado would stand the evaporative losses of water stored in John Martin Reservoir until it was "booked over" to the account of Kansas. RT Vol. 212 at 38. Transit losses between John Martin Reservoir and the Stateline would also be borne by Colorado. *Id.*

B. Contingencies Affecting Implementation of The Water Repayment Program.

Colorado witnesses acknowledge that a number of agreements and actions by others would be required in order to implement such a water repayment program. These include:

1. Acquisition of water from cities and farmers on an annual basis sufficient to meet program needs. The State of Colorado itself does not own water or water rights. RT Vol. 211 at 45-46; Colo. Exh. 1205 at 2.
2. State legislation to appropriate funds for the program, including the acquisition of water rights.
3. State legislation to establish a water bank; to authorize the State Engineer to adopt special rules for its administration; and to authorize the Colorado Water Conservation Board to operate the bank. RT Vol. 211 at 82-83.
4. State legislation authorizing the State Engineer to administer the temporary transfer of irrigation water and the fallowing of land for repayment to Kansas. Colo. Exh. 1205 at 2, 30; RT Vol. 211 at 84.
5. Agreement with the federal government to acquire storage rights in John Martin Reservoir. RT Vol. 212 at 48.
6. Agreements with other entities having storage rights in John Martin Reservoir. *Id.* at 48-49.
7. Agreement with the State of Kansas in regard to transferring water from Colorado's repayment account in John Martin Reservoir over to a Kansas account. RT Vol. 212 at 38.

8. Additional monitoring to ensure that lands irrigated by acquired shares or water rights are actually fallowed. Colo. Exh. 1205 at 3.
9. Amendment of some of the ditch company bylaws to permit the transfer of water out of their service areas. Colo. Exh. 1205 at 30; RT Vol. 211 at 83; RT Vol. 212 at 25.
10. Administration of the program so that no injury would be caused to the holders of other water rights. Colo. Exh. 1205 at 4; RT Vol. 212 at 50.
11. Some measure of cooperation from Kansas. RT Vol. 212 at 51-52. Kansas would have to "want to make this work." [Eisel] RT Vol. 212 at 51. The program has "political complexities" and "it clearly depends on, frankly, the attitude and participation of the State of Kansas." [Lochhead] RT Vol. 211 at 89-90.

Despite these contingencies and problems, however, it was the opinion of both Mr. Lochhead and Dr. Eisel that the water repayment program could be successfully implemented. RT Vol. 211 at 90; RT Vol. 212 at 47.

C. Availability of Repayment Water.

Dr. Eisel conducted a feasibility level investigation on the availability of water for the repayment program. He did not receive firm commitments from any source. Nor did he estimate what the cost of water acquisitions might be. Nonetheless, after his investigation, he concluded that sufficient water could be acquired, and at prices for which the Legislature would appropriate funds. RT Vol. 212 at 47. Mr. Lochhead held the same view. RT Vol. 211 at 90-92.

Colorado proposed first to acquire excess water from the cities of Pueblo, Colorado Springs, and Aurora. Pueblo was the most promising, indicating that it might have 10,000-13,000 acre-feet of fully consumable water available each year for a period of up to 20 years. Colo. Exh. 1205 at 17. While both Colorado Springs and Aurora were willing to discuss making excess water available, Dr. Eisel testified that there was "some question" whether Colorado Springs would have water available on a firm basis, and it was not clear that Aurora would have any water in dry years, unless an exchange agreement could be worked out with the City of Denver. RT Vol. 212 at 16, 21.

It also appeared that 12,000 acre-feet per year of fully consumable water might be available from New Century Energies. This company is the successor to the Public Service Company of Colorado which had acquired shares of stock in the Las Animas Consolidated Canal Company and the Consolidated Extension Canal Company for cooling water in connection with a proposed new power plant. Colo. Exh. 1205 at 17. The plant has not been built, and the water stock has been leased back to farmers on a temporary basis.

While these were considered to be "attractive sources" of repayment water, Dr. Eisel concluded that it would also be necessary to acquire water supplies presently used by irrigated agriculture. He proposed the establishment of a water bank to lease water rights and shares in ditch companies currently used for agricultural irrigation. Colo. Exh. 1205 at 18. His preference was to lease shares on a short term basis and fallow the land, rather than acquiring water rights on a permanent basis.

RT Vol. 212 at 25-26. The notion was to rotate fallowed lands in order to spread out the economic and environmental impacts. Based upon meetings with various ditch companies, Colorado concluded that there was "significant interest" among ditch company shareholders in participating in a water bank program. Colo. Exh. 1205 at 19.

D. Kansas' Concerns over the Water Repayment Proposal.

Five Kansas experts analyzed the water repayment proposal and testified as to various problems and concerns outlined below. These witnesses, in order, were C. Eugene Franzoy, Norman K. Whittlesey, Dale E. Book, Gregory K. Sullivan, and David L. Pope, Chief Engineer for the State of Kansas.

1. An underlying assumption of Colorado's water repayment program was that no further depletions would occur after 1996. Colo. Exh. 1205 at 6. Kansas experts challenged this assumption, testifying that the 1996 Use Rules would still leave depletions of approximately 7,335 acre-feet annually. Kan. Exh. 1027 at 30 *et seq.*, Table 4. Compact compliance for the years after 1996 was not part of this trial segment, and so the issue of any current depletions was not pursued. However, the Kansas evidence raises the question of whether excess water earmarked for the repayment program would be needed for current compact compliance.

2. Kansas experts were also of the opinion that Colorado had overestimated the amounts of excess municipal water potentially available. Based on information provided by the cities, Kansas concluded that the

sources would vary between 12,700 and 37,700 acre-feet annually, depending upon the type of hydrologic year. Kan. Exh. 1027, Table 2. Kansas evidence also reduced the yield of the power plant water by about one-half during dry years. Kan. Exh. 1027 at 18.

3. In regard to land fallowing for the water bank, Kansas concluded that approximately 43,000 acres annually would have to be fallowed, and perhaps more in some years. Kan. Exh. 1027 at 35, Table 7; RT Vol. 213 at 54-55. This amount included approximately 6,000 acres already being fallowed for current compact compliance. Colorado did not agree with this conclusion, but if it were true, Mr. Simpson testified that any such magnitude for fallowing would not be acceptable in Colorado. He stated:

> "SPECIAL MASTER: I understand that you may not agree with that amount. I'm just asking that if that were true, do you think that that's an order of magnitude that can be accepted by Colorado?
>
> THE WITNESS: No, I do not. That would be a large amount of dry-up, probably fairly significant impact on local economies. I can't imagine that we would get that type of sign-up or enrollment in the program unless we offered a significant incentive to do so, and that would drive the costs of the program up probably well beyond which would be appropriate, especially in light of the current situation with our legislature." RT Vol. 214 at 66-67.

4. Kansas also estimated that about 150,000 acre-feet of storage would be required, in contrast to the

30,000 acre-feet used by Colorado. Kan. Exh. 1027 at 35, Fig. 4; RT Vol. 213 at 57.

5. Mr. Pope also testified that there was a "fairly serious question" about whether Kansas farmers could use an additional 40,000 acre-feet of water in wet years, and at times whether they would have sufficient canal capacity to accept these flows. RT Vol. 214 at 11-13. Mr. Pope believed that an operations study would be required in order to fully evaluate the proposal. *Id.* at 21-22.

6. Finally, several Kansas experts testified that Colorado was underestimating the complexity of administering the fallowing program, and the accounting that would be required in John Martin Reservoir. RT Vol. 212 at 109-110, 114; RT Vol. 212 at 127-28, 132; RT Vol. 214 at 6-7, 18-19. Mr. Simpson thought that these problems might be "overstated," but that Kansas did raise "some legitimate concerns." RT Vol. 214 at 52, 57-58.

E. Conclusion.

Kansas has consistently sought a remedy in money damages, while Colorado's initial support for a water remedy, although not specifically withdrawn, has obviously diminished. As the Supreme Court has noted, making up past shortages by delivering more water has "all the earmarks of specific performance, an equitable remedy that requires some attention to the relative benefits and burdens that the parties may enjoy or suffer." *Texas v. New Mexico*, 482 U.S. 124 at 131. And here the plaintiff does not seek such equitable relief. Moreover, the total shortage has accumulated over almost fifty years. If this

were a money debt, the full amount would be due upon judgment and would bear interest if not paid. Allowing another fifteen years to settle the account in water, by paying simply the amount of the judgment, does not make Kansas whole. But aside from this inequity, and more fundamentally, I believe that the successful implementation of the water repayment program is too uncertain to be relied upon in a judgment. Kansas should be compensated for its past losses by monetary damages.

RECOMMENDATIONS

Following my Second Report in September of 1997, additional trial proceedings were held in May of 1998 to consider Colorado's compliance with its compact obligations for the period 1995-96. Then in November of 1999 the damage phase of the trial commenced, and was completed at the end of January 2000 as to damages through the year 1994. This Third Report presents my recommendations in connection with these trial proceedings. Accordingly, I recommend:

1. That depletions of usable Stateline flow for the 1995-96 period be determined to be 7935 acre-feet, bringing the total depletions for 1950-96 to 428,005 acre-feet. (July 28, 1999 Order, Exhibit 6 of the Appendix)

2. That the Court confirm my rulings (Exhibits 1 and 2 of the Appendix) that if a suitable remedy includes money damages, those damages should be based upon Kansas' loss rather than upon any gain to Colorado.

3. That the Court confirm my ruling (Exhibit 3 of the Appendix) that if a remedy includes money damages, the Eleventh Amendment does not preclude damages awarded to the State of Kansas from being based, in part, upon losses incurred by its water users.

4. That the court confirm my ruling (Exhibit 4 of the Appendix) that the unliquidated nature of Kansas' claim for damages does not bar the award of prejudgment interest.

5. That the remedy in this case should be in monetary damages, rather than repayment of the historic shortage by additional water deliveries.

6. That Kansas' damages should be determined on the basis of the analyses used by the Kansas experts.

7. That the categories of Kansas' damages should be calculated as provided in Sections V, VI, VII, VIII, IX and X of this Third Report.

8. That Kansas' damages should include prejudgment interest as provided in Section XI of this Third Report.

9. That my March 22, 2000 Order (Exhibit 7 of the Appendix) re mitigation of damages be confirmed.

10. That my May 1, 2000 Order (Exhibit 8 of the Appendix) re Colorado's objection to expert testimony on secondary economic damages be confirmed.

If the Court finds in accord with my recommendations in this Third Report, or otherwise, then I recommend that the case be remanded for further evidence: (1) to recalculate Kansas' damages in accordance with this Report, or as the Court may otherwise direct; (2) to calculate Kansas' damages for the period following 1994; and (3) to consider Colorado's compact compliance for the period after 1996, and any further depletions that may have occurred since that date.

Date: August 11, 2000

Respectfully Submitted,

ARTHUR L. LITTLEWORTH
Special Master